1809
XLIV

FLIGHT

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and
The AIRCRAFT ENGINEER

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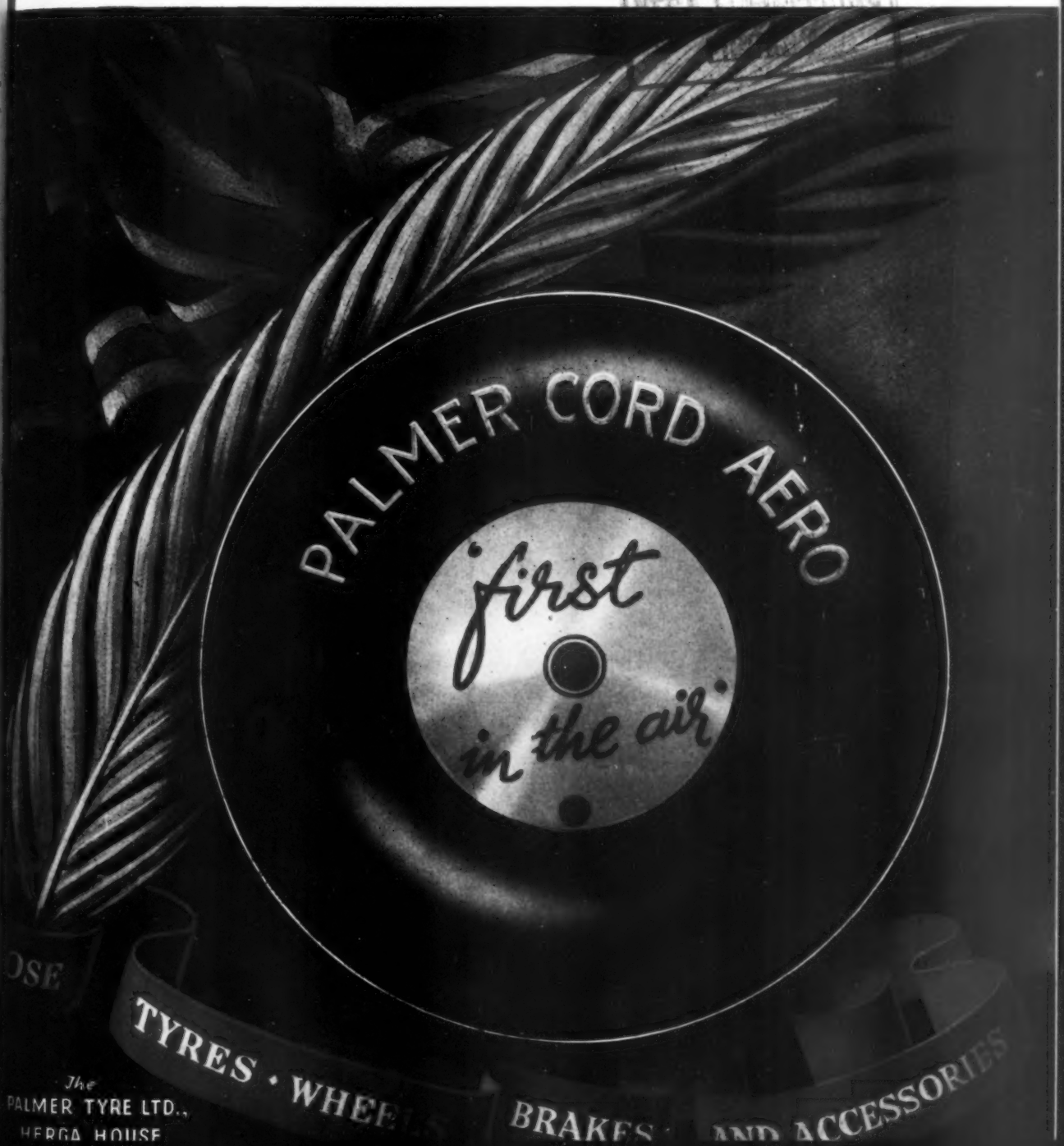
AERO ENGINEERING



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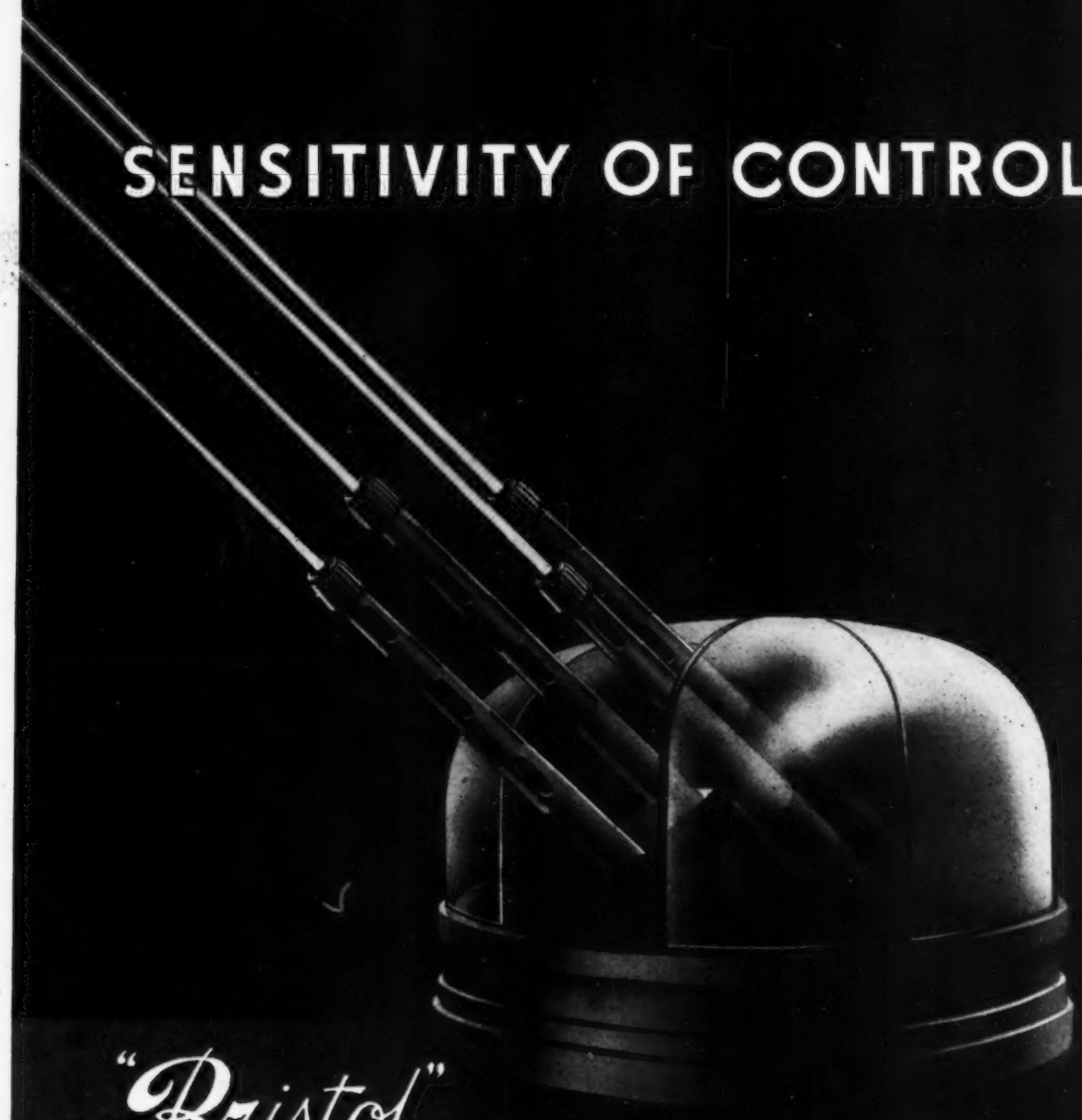

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and
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FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Aircraft Production

"AT present, with the exception of spares . . . there is no single field of production where a serious bottleneck threatens to retard output." When one remembers the lean years before the war expansion, when orders from the Air Ministry were few and small, this statement from the Tenth Report of the Select Committee on National Expenditure is not merely gratifying, it is astounding. That the industry and the M.A.P. should have reached such a satisfactory organisation of the vast network of aircraft production is something to be proud of indeed, and reflects the very greatest credit on everyone concerned.

That there is still room for improvement goes without saying but, as the Committee states in its report (a summary of which will be found on pp. 223-225), since the major bottlenecks are being removed, and since the limits of expansion of the labour force are being approached, it follows that increase in output of aircraft must be sought mainly by all-round improvement in the efficiency of the industry.

The exception to the generally satisfactory state of the aircraft industry, that of spares production, evidently causes the Committee some anxiety, and it comes to the conclusion that although the contractor (i.e., the aircraft constructor) is, under the present system, responsible for making out lists of minor spares, the ultimate responsibility rests on the Ministry of Aircraft Production and the Air Ministry, and that the Ministries "should ensure that contractors submit lists of minor parts required as spares without delay and should consider them promptly."

That sounds to us rather a counsel of perfection. The problem of spares is extremely complicated. How *can* an aircraft manufacturer about to go into large-scale production of a new type know just which "minor parts" are most liable to damage and therefore likely to need spares? Not until actual operational experience over a long time has become available can it be known which components will be wanted. The initial spares contract details deliveries of such parts as wings and tail units, but as to the smaller parts the constructor is left to guess as best he may. In the old days, when new types were tested at Martlesham and then went on squadron trials, it was rather a different matter. For such leisurely progress there is no time at present. Thus it is a little difficult to share the evident surprise of the Committee at the fact that "The average period between the date of the airframe contract and the submission of these lists was four months, and in one case the period was as much as nine months." To us it seems that an average time of four months must be considered remarkably short, bearing in mind the difficulties of judging which parts are likely to need renewal.

Efficiency of the Industry

HAVING examined the possible sources of bottlenecks, the Committee on National Expenditure turns its attention to the possibility of improving the efficiency of the aircraft industry, and a number of proposals for doing this are contained in the Report.

We welcome the very succinct appraisal of the difficulties which arose out of the panic expansion of the aircraft industry in the years immediately preceding the war. "Success," the Report states, "depended on the merit of the design and the performance of the aircraft. As a result, firms tended to concentrate on design; ease of production and efficiency in methods were regarded as of secondary importance. To this is due in large measure the pre-eminence of British aircraft design. But equally as a consequence the industry was with one or two exceptions not adapted in its outlook and organisation to large-scale production."

That seems to be a very fair and concise summing up of the position.

The Committee applauds the appointment of a technical advisor who is an aircraft engineer to help the Chief Executive of the M.A.P., and suggests that more appointments of this kind could usefully be made. The aircraft engineer referred to is, it may be recalled, Mr. E. Mensforth, managing director of Westland Aircraft.

While realising that the vast degree of dispersal, originally dictated by considerations of safety when enemy bombing was a serious menace, is now needed for its extra manufacturing capacity, the Committee feels that, in view of the fact that dispersal no longer is so important on safety grounds, the situation should be reviewed. That is a view which will be shared by many. The wastage in transport, and the relative inefficiency which must necessarily accompany the use of small units with low production capacity and need for separate managements, must preclude the achievement of maximum economy of production.

Technical Personnel

THE agitation which certain sections of the community (including *Flight*) have been carrying out concerning technical training finds strong support in the Report, which states:—

> "The aeronautical industry in this country is suffering from an acute shortage of scientific and technical men, and there are not enough adequately qualified men available to maintain the industry at the proper level of efficiency."

It is pointed out that men of high scientific and technical achievements, "even when they are employed in technical jobs," often have higher qualifications than are needed for these jobs. We like the sly dig contained in the sentence quoted.

The Committee urges that more pre- and post-graduate courses in aeronautics are needed at the universities. In this connection we would refer to a letter by our managing editor on p. 231 of this issue.

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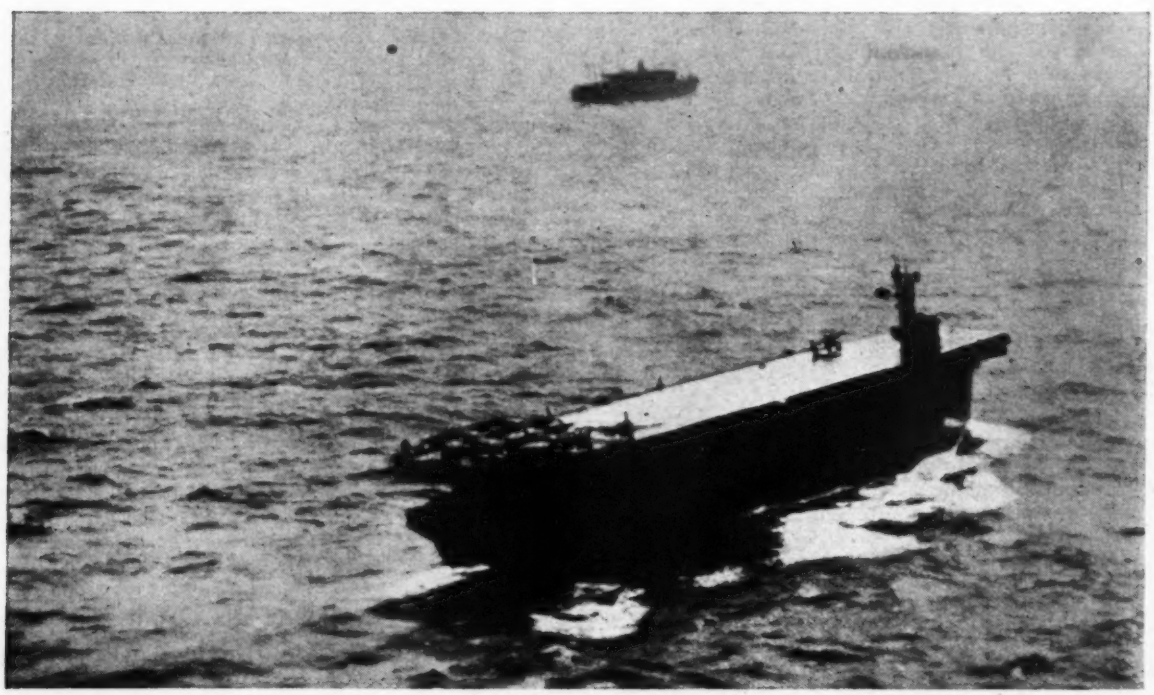
Price-fixing

AMONG the many aspects of aircraft production dealt with in the Report is that of price-fixing. On the whole the Committee comes to the conclusion that excessive earnings are almost entirely confined to a few firms and to certain kinds of occupation within those firms. In the main, excessive earnings arise from piece-rates which were fixed before sufficient experience had been gained, and they can only be altered afterwards by agreement between employers and workers. The Committee recommends that the Ministry of Labour should negotiate with a view to bringing such rates into line. That appears to us a pious hope unlikely to bear fruit. Our information is that the Ministry of Labour is more likely to say "Good Luck" to those drawing fantastically excessive rates.



BABY "FLAT TOP": One of the new convoy escort aircraft carriers. They are actually flying decks built on merchantmen hulls. These, and the very-long-range air patrols, have served to close the air-coverless gap in the Atlantic.

AIR FLOTILLA: A formation of cannon-armed Seafires. The bend of the arrester hook can be seen projecting slightly beneath the fuselage.

WAR in the AIR

Sicily Conquered : Pursuit Carried Into Italy : The Axis Struck from All Sides : Great Work in the Pacific

TUESDAY, August 17th, was a black day for the Axis. Following on a night in which Bomber Command, using Stirlings for the most part, raided the Fiat works in Turin, the American Seventh Army occupied Messina in the early morning, thus bringing to an end the conquest of Sicily after a campaign which lasted only 38 days. In the afternoon a formation of Fortresses of the N.W. Africa Strategic Air Force flew across the Mediterranean to Marseilles and bombed two airfields in the vicinity, Istres and Salon, making a round trip of about 1,000 miles; while a Wellington torpedo-bomber sank a ship at Imperia, about 40 miles east of Nice. At the same time the U.S. Eighth Air Force in Great Britain sent a strong formation deep into Germany, in fact into the old kingdom of Bavaria, to attack the large Messerschmitt works at Regensburg and other targets at Sweinfurt. This was a particularly gallant enterprise, for the American bombers had to fight their way in from the coast against repeated attacks by fighters. The raid, however, will, it is hoped, materially retard the output of Messerschmitt fighters and other aircraft for a considerable time ahead. Finally, on the Tuesday night Bomber Com-

PARA-LIFEBOAT: Airborne lifeboats which can be dropped by triple parachutes are now employed on air/sea rescue work. They have both sails and auxiliary engines and they were first used in May this year to rescue a Halifax crew 50 miles out to sea.

WAR IN THE AIR

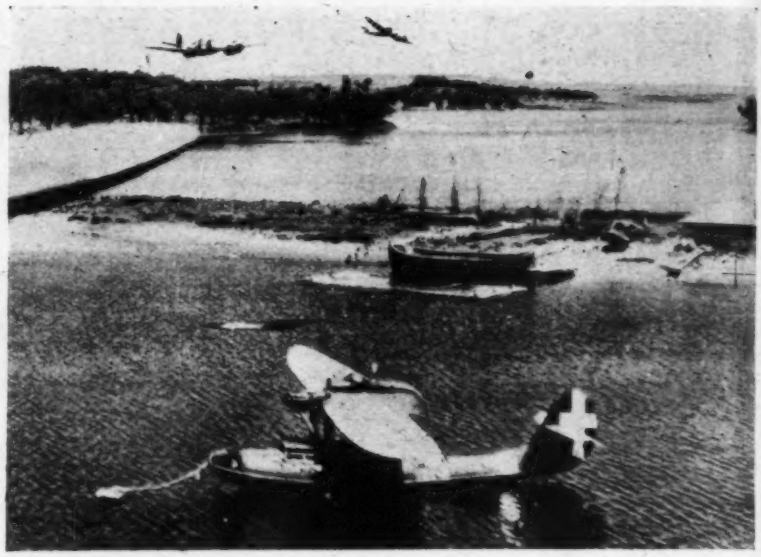
mand raided the German research and development station at Peenemünde on the Baltic coast, 60 miles to the north-west of Stettin and 700 miles from Britain. Peenemünde might be called the German equivalent of the R.A.E. at Farnborough. It was a difficult target, for the buildings had been cunningly strung out for some miles among woods, and the defences were very strong. The British loss was 41 aircraft, a higher figure than has been sustained for some time past, but this testifies to the gallantry and determination of the crews and also to the value placed by the enemy on the place. The results of the bombing are believed to have been very good. As a sort of *bon bouche* a few Mosquitoes bombed Berlin. The exterior lines of the Allies now permit of air attacks on "the European stronghold" from all directions.

The Fortresses which raided Regensburg flew on to airfields in Africa, giving yet one more example of how the northern and southern fronts are now linked together.

Air Pursuit

WITH the fall of Messina the minor Dunkerque promptly ceased, and the allied aircraft and warships quickly turned their attention on to the roads, railways and harbours of the Italian mainland. The Royal Navy shelled both the west and the east coasts of Italy, and the aircraft pursued the fugitives from Sicily. During the real Dunkerque in 1940, British and French soldiers were safe as soon as they reached the shores of England, but that was not the case with all the Germans and Italians who escaped from Sicily to Calabria. There, there was nothing like the R.A.F. Fighter Command to hold off the pursuing bombers, and many soldiers who had escaped from the island met their fate on the mainland.

ATLANTIC BATTLE SCENE: Aerial depth-charges (shown by circles) dropping on a German U-boat. One is actually glancing off the side of the conning tower. The submarine surrendered within 12 minutes of being attacked.



TARGET IN GREECE: Close-up of a Cant Z.501 taken by a Beaufighter during an attack on the seaplane base at Preveza on the west coast. Two other Beaufighters can be seen in the background.

Allied fighter pilots have been surprised to encounter Italian aircraft with unfamiliar markings on them, but the explanation was found to be that emblems of the Fascist party have now been expunged and national markings substituted. Another and rather similar puzzle has been presented in Northern France, where on several occasions lately machines of German types have been seen with Italian markings on them.

Attention has naturally been so concentrated of late on the splendid victories in the Mediterranean that one is apt to overlook the persistent hard work being done by fighters and fighter-bombers which start off from Britain day after day and night after night to harry the Germans in France and the Low Countries. They were particularly busy on the memorable August 17th, and they and medium bombers ranged far and wide. These operations tie down a very large proportion of German fighter squadrons to that area, and it is extremely important to keep them there at the present juncture when the enemy would only too dearly like to be able to send them elsewhere.

Likewise we must not forget the ceaseless harrying of German shipping by Coastal Command aircraft or the continual laying of mines in enemy waters. The attacks on the shipping usually call for great daring and skill on the part of the crews of Beauforts and Beaufighters, but the day-by-day incidents cannot all be recorded here. All these operations combine to hamper the German war effort, and the best record of them is to be found in the list of decorations conferred on the crews, which are published on other pages of *Flight*.

The Japanese War

GENERAL MACARTHUR'S reach is growing longer and longer. The air is his main arm still, but he uses his naval and military forces with skill and initiative as the situation calls for new moves. The seizure of the island of Valla Lavella, in the New Georgia group, took him a step nearer to what must be his first chief objective, Rabaul, and when the Japanese sent a convoy of barges and destroyers to retrieve the position, American naval vessels attacked and scattered the destroyer escort, and then proceeded to sink most of the barges. Only 300 Japanese soldiers are believed to have reached the shore, and they were in no condition to attack the American troops; in fact, they promptly disappeared into the jungle.

Meanwhile, the enemy massed over 200 aircraft round the base of Wewak, in New Guinea, evidently intending some sensational development, but a series of attacks by the Allied bombers destroyed nearly all of them at slight cost. In addition, there have been raids by Liberators on oil stores at Balikpapan, in Borneo. These have

WAR IN THE AIR

ENEMY AIR LOSSES TO AUG. 21st

	Over G.B.	Continent	Middle East	N.W. Africa
Aug. 15	6	8	0	3
,, 16	2	3	43	0
,, 17	7	19	0	8
,, 18	0	1	0	8
,, 19	0	15	4	40
,, 20	0	0	0	14
,, 21	0	1	25	26
	15	47	72	99

Totals: West, 7,275; Middle East, over 5,606; North West Africa, 2,866.

BRITISH & U.S. AIR LOSSES to AUG. 21st

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Aug. 15	0	11	8	0	5
16	0	13	11	8	4
17	0	77	7	0	9
18	0	0	2	0	3
19	0	5	8	4	17
20	0	1	0	1	10
21	0	0	1	1	6
	0	107	37	14	54

Totals: West, 7,245; Middle East, about 2,226; North West Africa, 1,079.

been 'mighty feats, involving round flights of some 2,500 miles, and they must have come as a nasty surprise to the enemy.

In Burma the British and American aircraft have been able to defy the monsoon, thanks to remarkably accurate work by the meteorologists, and have continued to raid the Japanese, striking mostly at sampans on the rivers.

The Japanese have evacuated Kiska, in the Aleutians, and it has been occupied by American and Canadian troops, whose landing was covered by warships and aircraft of both the Republic and the Dominion. This is a result of the recent re-conquest of Attu Island, but it is very satisfactory, not only because Kiska has a good harbour, but also because it is the first time the Japanese have moved backwards without fighting to the last man. Admiral Tojo will find it difficult to "save face" in explaining this retreat, if he ever feels it necessary to mention it. Meanwhile he must be wondering what plans have been hatched by the conference at Quebec.

In Italy railway junctions and roads occupied the attention of the Allied Air Forces after the fall of Sicily.

The Russians rounded off a most successful advance by occupying Kharkov.

FRIENDLY MARAUDER: The Martin B 26 (Marauder) has been operating for some while in the Middle and Far East. It is now being operated from bases in this country by the U.S.A.A.F. A crew of five is carried and top speed is 346 m.p.h. Bomb load is 2,400 lb., and the engines are 2,000 h.p. Double Wasps. Wing span 65ft. For defence or offence eight 0.5in. machine guns are carried, four of them in power-operated turrets.

TRIBUTE TO COASTAL COMMAND

STRIKING tribute to the work of Coastal Command of the Royal Air Force is paid by the War Cabinet in the following message which has been sent by Sir Archibald Sinclair, Bt., Secretary of State for Air, to the A.O.C.-in-C., Coastal Command:

"I am charged by the War Cabinet," states Sir Archibald Sinclair, "to convey to you an expression of their gratitude and admiration on the outstanding success achieved by your Command in the battle against the U-boats. This battle has not paused since the war began, and your aircrews have flown in all weathers interminable miles over the seas to search out and destroy the enemy, often driving home their attacks with unsurpassed gallantry at low level in the face of heavy opposition.

"To all members of your Command, in the air and on the ground, their work may at times have appeared unspectacular by comparison with that of other Commands of the Royal Air Force. Their unwearying efforts have, however, brought great success in this most vital task, which earns for them the proud thanks of the nation and the Empire. These thanks are due alike to British, Czech, Norwegian, and Polish squadrons of the Royal Air Force, to the squadrons of the Royal Australian, Canadian, and New Zealand Air Forces, and to those of the United States Army and Navy operating with your Command.

"The War Cabinet charge me, therefore, to convey to you and to all ranks under your Command their admiration of this strenuous endeavour and their thanks and congratulations upon the success with which it has been crowned, especially during the month of July."

The A.O.C.-in-C., Coastal Command, Air Marshal Sir J. C. Slesser, K.C.B., has replied:

"Please accept my sincere thanks on behalf of all ranks in Coastal Command for your signal conveying the appreciation of the War Cabinet, which will be an inspiration to all ranks."

A.T.A. BENEVOLENT FUND

Latest List of Subscriptions

	£	s.	d.
Donations already acknowledged	8,035	11	7
Subscriptions by members of the A.T.A. and B.O.A.C.	2,775	17	7
Necaco, Ltd.	25	0	0
Tipsy Aircraft Co., Ltd.	10	10	0
Scottish Aviation Social and Welfare Club, Barrfields, Largs	5	5	0
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HERE AND THERE

Fantastic Paragraph

THE following extract is taken verbatim from The Marquess of Donegall's column in the August 22nd edition of *The Sunday Dispatch*:—

"One of the most fantastic paragraphs that it has been my misfortune to read since this war started appeared in the (Birmingham) *Evening Despatch* last Wednesday.

"Under the heading 'Packard Engines Saved Britain,' the newspaper continued:

"'The Packard-built Rolls-Royce engine was the literal saviour of England,' said Peter Masefield, the British air correspondent, after he had toured the Packard plant.

"'Your shop conditions astound me,' he added.

"'What I have seen is an encouraging sign of British and American relations.'

"Good Enough?"

"Ye gods and little fishes! What on earth has happened to Peter Masefield and/or the editor of the *Evening Despatch*?

"I suppose that the editor can excuse himself on the grounds that his sub-editors have orders that anything to butter-up America is good enough for them.

"Whether false statements that butter-up America and infuriate the entire British aircraft industry are good for Anglo-American relations is quite a different matter.

"But something very strange seems to have happened to Peter Masefield. I remember him very well. We were both accredited to the Advanced Air-striking Force at Rheims in '39 and '40. And well do I remember his opinion at that time.

"A Volt-face"

"Anyone who has read *The Aeroplane*, of which he is assistant editor, can hardly have escaped his erstwhile opinions.

"Surely such an expert must know that the first Rolls-Royce Merlin engine left Packard's production line about a year after the Battle of Britain was finished and won."

It should be explained that Peter Masefield is in America following his retirement in June from the staff of our contemporary. *World's Press News* stated that he "has joined H.M. Forces. His period of deferment recently expired."

Masefield told his friends that he was joining the A.T.A.

W.A.A.F. Ferry Pilots

VOLUNTEERS from the W.A.A.F. are being invited to fill a limited number of vacancies for women ferry pilots in the A.T.A., who will give them instruction at their own flying training school.

Only single women between the ages of 20 and 25 are eligible, and these must, of course, possess the necessary physical and educational standards; they are required to have matriculated or have gained the school certificate or the equivalent

The Air Ministry has already circulated to R.A.F. commands and groups a letter inviting applications from eligible W.A.A.F. personnel.

Married women are not being accepted because, it is reported, the number of volunteers will probably far exceed the number of vacancies.

R.A.F.'s Jungle Theatre

AN R.A.F. Blenheim squadron in Bengal claims to possess the only permanent jungle theatre in the forward area.

Other units have rough-and-ready stages built in canteens ready for visiting concert parties, but this squadron has fitted up a disused dining hall with a proper stage complete with lighting effects and control panel, colourful curtains made from Army blankets, and all sorts of ingenious props made from various odds and ends.

They have their own company and orchestra, and recently ran, for five nights, their second edition of light revue.

Follow the Green Lights

ACCORDING to the Germans the R.A.F. are using a new method of bombing. At the beginning of a raid the R.A.F. mark the target area by a series of "rings" of green flares, and the following waves of bombers drop their bombs on the periphery of these rings so as to cut off the German A.R.P. personnel. The interior of the rings, it is said, are then littered with bombs and incendiaries.

***ACTON'S* CREW: F/O. J. G. Uren (on the right) and F/O. R. C. Bevington, pilot and observer respectively of one of the first two Canadian-built Mosquitoes to fly here from the Dominion. The other was named *New Glasgow*. With three others, *Vancouver*, *Saskatoon* and *Moose Jaw*, they were christened at the de Havilland factory near Ontario before setting out for Britain via Greenland and Iceland.**

Appointment and Promotion

AIR VICE-MARSHAL N. H. BOTTOMLEY, who was appointed Deputy Chief of Air Staff early this month, has been gazetted Acting Air Marshal.

F.A.A. Badges

ALL officers on the active and retired lists who have at any time qualified as pilots or observers in the Fleet Air Arm should wear the Fleet Air Arm pilot's or observer's badge, according to a Fleet order.

The appropriate Fleet Air Arm badge should also be worn by naval officers who have qualified as pilots or observers in another service, or in the Royal Navy Air Service.

Back in Harness

AIR CHIEF MARSHAL SIR ARTHUR LONGMORE has returned to the Air Ministry to act as an adviser on post-war problems and assumes the rank of Air Vice-Marshal. Sir Arthur was placed on the retired list on March 1st, 1942, at his own request, having been A.O.C.-in-C. Middle East from May, 1940, until early in 1941, and Inspector-General of the R.A.F. from July of that year until his retirement.

Born in Australia in 1885, he learnt to fly in 1911, and was one of the first four naval officers to do so. His R.Ae.C. certificate, granted in that year, is No 72.

Orlebar Memorial Suggested

FRIENDS of the late Air Comdre. Orlebar, A.F.C., are sending donations to Westminster Hospital in recognition of "the unremitting care" with which he was nursed during his last illness there.

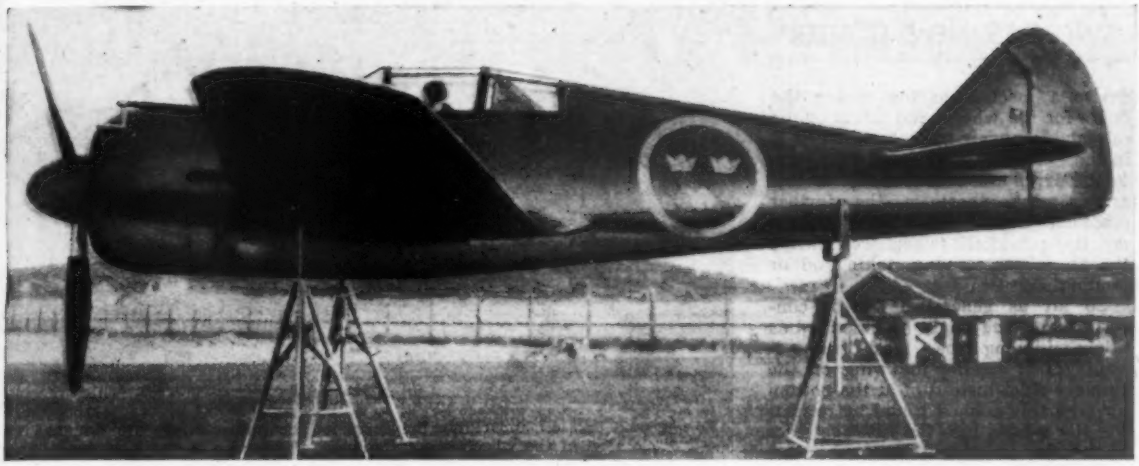
For these generous gifts the hospital is most grateful, and it approves the hope, expressed by one donor, that such gifts may form the nucleus of a fund for the endowment of a bed or beds for flying men in memory of this great airman.

Death of Mrs. Hewlett

WITH the death in New Zealand, at the age of 82, of Mrs. Hewlett, one more link with early British aviation has been severed. The wife of Mr. Maurice Hewlett, Mrs. Hewlett learned to fly in 1910-11 and was the first Englishwoman to obtain the Royal Aero Club's certificate.

Afterwards she established the Hewlett and Blondeau flying school at Brooklands, where she taught many pupils to fly, including her son, F. E. T. Hewlett, who fought with distinction in the 1914-18 war.

As mentioned in a leading article in last week's issue, he took part in the Cuxhaven raid on Christmas Day, 1914, came down in the sea and was rescued by a Dutch trawler. He retired with the rank of Group Captain before the outbreak of this war.



This side view of the J 22 gives a good idea of the careful finish. The tail is unusual in that the rudder is wholly aft of the elevator.

Sweden's New Fighter

National Production Forced Upon the Country by Inability to Purchase Abroad : J 22 Ordered "Off the Drawing Board"

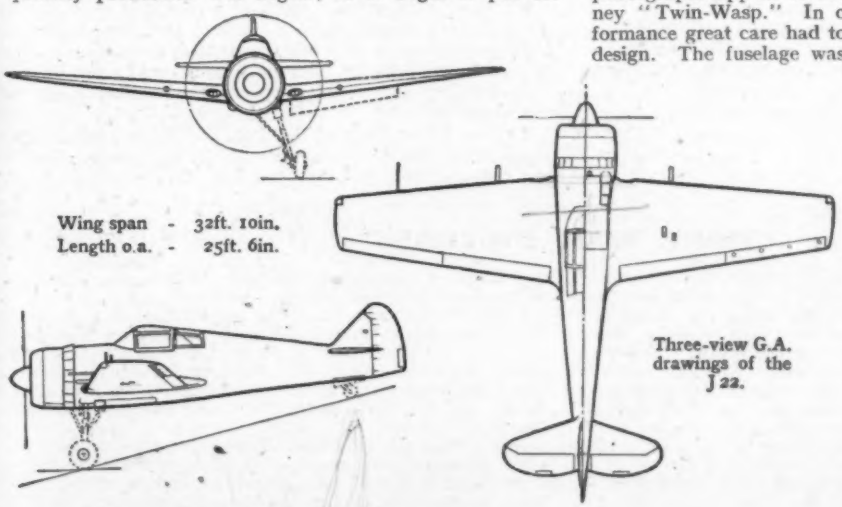
SWEDEN'S aircraft-designing industry has never been very large, her policy having been to depend partly on foreign aircraft built under licence and partly on aircraft purchased abroad. When the present war broke out Sweden had a number of American machines on order, but as she could not get delivery, and it was obvious that she would need a strong air defence, the Swedish Government decided to set on foot a scheme for designing and building a new fighter type to be manufactured almost entirely of "home-grown" materials by dispersed firms not normally engaged in aircraft work.

That this policy gave rise to many difficulties is understandable. There was the problem of getting together a design staff for the Government design office. Then there was the decision as to which would be the better plan: to spend a long time on the prototype and thus play for safety by ensuring that all "snags" should be eliminated before quantity production was begun; or to begin to put the production machines out to sub-contractors simultaneously with the beginning of manufacture at the Government experimental and design establishments. The latter course was chosen as being the quicker, although it brought with it considerable risks. If the prototype was not entirely satisfactory, changes would have to be made in the production types, and this would entail long delays and great expense It is greatly to the credit of the chief designer, Bo Lundberg, that, working largely with an untrained staff as he had to do, the first test flights of the prototype disclosed no serious defects or shortcomings, and no major modifications were required.

Design Considerations

The fighter, known as the J 22, had to be designed around a radial engine of relatively modest power. The Swedes themselves have not announced the type, but photographs appear to show that it is a Pratt and Whitney "Twin-Wasp." In order to get the maximum performance great care had to be taken over the aerodynamic design. The fuselage was given the smallest practicable cross-section behind a radial engine, and the form was made as near perfect streamline as possible without using double curvatures, which would have necessitated panel-beating. The latter would, in any case, have been impossible, since it was a stipulation that only a minimum of light-metal alloys should be used, Sweden's aluminium industry being already taxed to capacity, and the fuselage covering had to be of wood.

In order to get a short take-off run and good rate of climb immediately after unsticking, the designers went to a great deal of trouble to



Three-view G.A. drawings of the J 22.

SWEDEN'S NEW FIGHTER

devise a mechanism for closing the doors for the wheels and struts of the retractable undercarriage when this is in the "down" position. In addition to the aerodynamic advantage of this arrangement, there is the further practical point that dirt and mud are not flung into the wheel wells while the aircraft is taxying, taking off or landing.

So far as general design is concerned, the J 22 might be described as a low mid-wing type. Most of the advantages of having the wing on the fuselage sides instead of at the bottom are probably achieved, and by retracting the wheels into the fuselage sides at the wing junction it became possible to keep the thickness of the wing relatively small at the root. At the tips, however, the designers kept the wing thickness fairly great and cut off almost square, presumably in order to prevent tip-stalling at large angles of incidence.

To get good take-off and climb, the doors for the undercarriage are designed to close when the wheels are fully down. Thus also is dirt kept out.

Tail Surfaces

In cross-section the fuselage is egg-shaped. In the forward part the greatest width occurs at the level of the wing. As the tail is approached, however, the maximum width moves up, and at the tail it is on the level of the tailplane, which is set fairly high, thus providing a good anchorage for the tail. The arrangement of the latter is slightly unusual in that the fin trailing edge and the stern post for the rudder are aft of the trailing edge of the elevator. The object of the arrangement was to prevent air spilling over the inner ends of the elevators. That it is effective appears to be proved by the fact that the elevator control has been found to be powerful, although the elevators are smaller than is customary. Both rudder and elevators are aerodynamically balanced, partly by set-back hinges and partly by horn balances at the tips.

On the forward part of the fuselage there are no projecting air intakes and no oil coolers. These are installed in the leading edge of the wings, and it is reported that a good "ramming" effect is obtained for the intake air.

To British eyes the wheels of the undercarriage are unusually far forward. While this should help to prevent nosing-over, one would imagine that this placing might tend to cause "swing," and possibly the designers thought the same, for the tailwheel is so arranged that when extended it is locked in the fore-and-aft position.

The J 22 is of mixed construction, with an all-wood wing (except for the flaps and ailerons, which have a framework of spot-welded stainless steel and fabric covering) and a fuselage having a welded steel tube primary structure, covered with birch plywood. Fin and tailplane are of similar construction and rudder and elevators are of spot-welded stainless steel, fabric covered. They are provided with trimming tabs.

The engine of the J22 is a Pratt and Whitney Twin-Wasp. It drives a Hamilton Standard three-bladed airscrew.

Pilots who have flown the J 22 report that it is easy to fly and very manœuvrable. Lateral stability is particularly good, even at very low speeds, and the rudder control is good past the stall. The machine is said to come out of spin readily, and at high speeds the control loads are moderate.

For the illustrations of the J 22, and for the information upon which above notes were based, we are indebted to our Swedish contemporary "Flyg," of Stockholm.

MORE WAR PICTURES

TO the already large collection of war pictures at the National Gallery was added another room of nearly 80 paintings and drawings. It is pleasing to think that a few artists can devote their talents to such a variety of war subjects. They form a valuable pictorial record of our times. Limestone quarries, dusty desert scenes, bomb-scarred London, hospitals and factories, portraits of notable personalities, everything from sea to sky is the field of their canvases. They are, of course, modern paintings, and as such will have no particular æsthetic pleasure to some admirers of, say, XVII-century art.

Stanley Spencer adds to his numerous large panels another important work. The artist sees the "New Brave World" dominated by mechanical, grotesque implements, where men are mere ant-heaps of jelly-like human forms.

Edward Ardizzone presents in graphic drawings the North African campaign. Among the many portraits by Henry Carr is that of Air Chief Marshal Sir Arthur Tedder, G.C.B., Air Officer Commander-in-Chief, Mediterranean, and William Dring contributes a pleasing one of Admiral Sir John Cronin Tovey, K.C.B., K.B.E., D.S.O., Commander in-Chief, Home Fleet.

R. V. Pitchforth exhibits ten water-colour paintings of subjects connected with aviation, airfields, runways, torpedoes; while Leslie Cole and John Armstrong include amongst their subjects parachutes and the building of gliders.

Balanced Aircraft Production

Select Committee Reports "No Serious Bottleneck," but Spares Position Unsatisfactory : Anxiety About Lack of Qualified Personnel

THE tenth report by the Select Committee on National Expenditure, issued as a White Paper on August 16th, deals with aircraft production. The Committee reaches the conclusion that most of the difficulties which formerly beset the industry have been solved or are on the way to being solved, and that since no serious bottleneck now threatens to retard output, production may be regarded as substantially balanced. Since the limits of expansion of the labour force are being approached, it follows that increases in the output of aircraft must be sought mainly by all-round improvement in the efficiency of the industry. A number of proposals for achieving this are contained in this Report.

During its inquiry the Committee visited sixteen firms engaged on the manufacture and assembly of airframes, undercarriages, aircraft engines and airscrews, and representatives of both management and workers were heard. Evidence was given on behalf of the M.A.P. by the chief executive; by representatives of several Production Directorates; by the Deputy Controller of Construction and Regional Services; by three Regional Controllers; by the Director of Contracts; and by the Director of the R.A.E., to which a visit was made. Representatives of the Ministry of Labour and National Service gave evidence of the calling-up of men in the aircraft industry; and the views of the industry as a whole were given by representatives of the S.B.A.C. Some fifty memoranda were submitted from official and non-official sources, including among the latter those from the Institution of Professional Civil Servants, the Association of Scientific Workers, and three Fellows of the Royal Aeronautical Society, selected by that body.

DURING its inquiry the Select Committee on National Expenditure, a summary of whose Report on Aircraft Production is given on this and the next two pages, visited 16 firms and heard evidence from both management and work-people. The Report discloses no serious bottlenecks, and output can only be increased by improving the efficiency of the industry. Proposals for doing this are contained in the Report.

The interesting disclosure is contained in the Report that the Minister of Aircraft Production has stated that the total weight of completed aircraft produced in this country in the first quarter of this year was more than half as much again as in the corresponding quarter of last year, and that the output of structure weight per person employed in March, 1943, was more than one-third greater than in March, 1942. These facts indicate the progress of the industry both in regard to total output and efficiency.

Planning the Programme

On the subject of co-ordinating production with research and development the Report points out that results in the past have not always been happy, as shown by the vicissitudes of certain types, the development and production of which have suffered through failure to achieve the necessary co-operation. It is held that appointment last October of an Air Chief Marshal (Sir Wilfrid Freedman.—ED.) to be Chief Executive of M.A.P. was a step in the right direction.

Concerning the allocation of productive capacity the Report offers the criticism that, whereas in the early days of expansion a high degree of co-operation was attained between the Air Ministry and the industry in drawing up plans through the Air Supply Committee, the relationship has not been so close since then. The Ministry of Aircraft Production inclines to prefer separate contracts with firms or groups of firms engaged on the same type of aircraft rather than with the industry as a whole. It is not suggested that there is any lack of consultation about changes of programme with the firms immediately concerned.

"Approached individually," the Report states, "with a proposal that he should undertake a particular part of a new programme, a contractor is hardly in a position to offer sound reasons why he should or should not accept it. Confronted collectively with the complete new programme, the industry might well offer constructive suggestions which would help the Ministry to distribute the work to the best advantage."

When changing over from an old to a new type, loss of output has often been a subject of criticism, especially by the workpeople. A technique has now been evolved for minimising the loss of production. It is now the practice of M.A.P. to make a programme for the development of a new type so that should difficulties arise, arrangements, particularly the ordering of materials, can be made well in advance to prolong the programme of the old type.

Manufacturers complain of the frequency of changes in the monthly delivery programme. One firm received three different programmes in one week, and another, engaged in full production on a well-established type, had its programme changed seven times in eight months.

Modifications are now understood by the industry to be necessary, but some concern is expressed at the cumulative effect of a number of modifications, each justifiable in itself, on the performance of an aircraft.

The Report throws an interesting light on the subject of dispersal of factories. Nineteen main aircraft firms which, in January, 1938, managed 45 production units each employing more than 100 workpeople, were at the beginning of this year managing 323 such units. One large group, which contributes 85 units to the above total, has in addition some 265 smaller units under its direct control.

Output of engines, the Report states, is generally up to programme, and in a few cases slightly above it. The output of spares is not, however, entirely satisfactory, and the subject is referred to in more detail below.

Undercarriage production has not been free from serious difficulties, but the Committee offers no observations at this stage. On the method of ordering undercarriages, however, the Report has a good deal to say. By the system in force, whereby the aircraft is ordered complete with undercarriage, it is the responsibility of the aircraft firm to provide it, the distribution of orders for undercarriages depends on the preference of aircraft-designing firms, and one undercarriage maker may be overloaded with work while another is short of orders. The Committee agrees that on general principles it is advantageous to place as large a proportion as possible of the aircraft on embodiment loan, and there is a tendency in that direction.

Standardisation of undercarriages is affected by the design of the aircraft, and standardisation of complete undercarriages might prejudice improvements in aircraft design, but undercarriage components are more amenable to standardisation, and a committee of representatives of firms specialising in undercarriages was formed in September, 1941. Standardisation has been reached, the Report states, on hand pumps and some half-dozen minor items, and a range of standard diameters for machined parts has been agreed. Progress has been slow. A smaller standard range of screw threads has been drawn up and approved by many manufacturers, but few have adopted it. Wheels, axles and forks, of which there are a great variety, were considered, but the agreement of aircraft constructors to a reduction in the number of types was not obtained.

The acute airscrew shortage which at one time threatened to become a bottleneck has been relieved. The Report points out that there are two airscrew designing firms, and that a technical committee of the S.B.A.C. rejected the suggestion that one should be selected on the grounds that the loss of output caused by the change-over would outweigh the advantages.

Spares

One aspect of aircraft production with which the Committee is not satisfied is that of spares. To some extent it blames the industry, taking the view that managements have felt that they received less credit for the production of spares than of

BALANCED AICRRAFT PRODUCTION

complete aircraft. Certain firms suggested that manufacture of spares should be segregated in a separate factory. This was rejected on the grounds that factories were already laid out so as to be capable of producing spares.

The Committee arrives at the conclusion that the more serious factor in spares production arises from its organisation. Nearly every manufacturer complains that orders for spares are not given at the same time as orders for complete aircraft. An investigation into 27 airframe contracts showed that there was little or no delay in placing initial spares contracts for complete wings. There was, however, in many cases considerable delay in submitting lists of minor parts.

Composition of Industry

The main aircraft industry, as distinct from the ancillary and sub-contracting firms, consists of a number of firms of widely different character, organisation and experience. They can be broadly divided into what can be termed the professional aircraft firms, and other engineering firms which have been brought into the industry since rearmament began. But even within the first category there is a wide diversity. On the airframe side there are two large groups consisting of firms which each have their own management, but which are under the same general control. They thus enjoy the advantage of great financial resources and the pooling of experience of the group as a whole. Outside these two groups there are a number of firms, built up round small teams of designers and technicians, which have specialised in different types of aircraft.

Firms outside the normal aircraft industry also differ widely in character; there are several large firms with wide engineering experience and others whose previous activities have been mainly confined to the mass-production of motor cars.

In general, the solution to the problem of welding this heterogeneous collection into one efficient industry has been to make the professional firms into "parent" firms responsible for design and development, and to group round them as "daughters" the non-professional firms as purely manufacturing units. The parent firms supply drawings, master jigs, technicians to supervise the introduction of processes, plus helpful knowledge of the difficulties peculiar to aircraft engineering. There have been some complaints of inaccurate drawings and late information about modifications, but the parent firms have not always taken full advantage of the production engineering experience of the daughter firms.

In the aircraft industry's depression period before rearmament there was keen competition for the limited orders from the Air Ministry, and success depended upon the merit of the design and the aircraft's performance. Thus the industry put design first, counting ease of production and efficiency in their methods as of secondary importance. This meant that the British aircraft industry was, with a few exceptions, not adapted to large-scale production, but, on the other hand, its designs were pre-eminent.

Efficient large-scale production depends upon the design being easy to produce and upon the use of the best possible production technique. Improvement in design from the production viewpoint can be achieved gradually, and the Committee recommends that, where necessary, draughtsmen with actual experience in production engineering should be appointed to strengthen design staffs.

Close collaboration between the design and development department, the production planning department, and the actual workshops is essential, and to this end all three should be housed as close to each other as possible. But this is not always so, and attention should be given to this point.

Saying that it has been found necessary to take control of some of the less efficient firms, and in other cases to strengthen the management by the appointment of personnel from outside, the paper expresses the opinion that there are a number of other firms whose production technique needs improvement to a greater or lesser degree, but by less drastic methods. Something has been done in this direction by the Production Efficiency Board, but the committee thinks that more appointments like that of the Technical Advisor to the Chief Executive could usefully be made.

On the more strictly scientific side, the means whereby information is made available to the industry, including the publication of scientific papers, are regarded as adequate. The committee has found that firms in difficulties with technical problems can always get the fullest help from other firms when they ask for it. But some firms are reluctant to ask (for reasons of prestige) and production has been delayed while they went on struggling with problems beyond their own resources. Even in less technical matters, such as sub-contracting and store-keeping, some firms might show greater willingness to profit by the experience of others.

Special mention is made of the aircraft industry's slowness to employ statistical methods of quantity control; this neglect being apparently due to the erroneous belief that it can only be applied where large quantities of identical components are produced. Actually, such methods can be applied to batches of machined parts as small as fifty, and their peculiar virtue lies in the fact that they make it possible to take action *before* the rejection rate has risen above the permissible level. These methods are thus of special value in aircraft manufacture where a high degree of precision is required and, in consequence, scrap is likely to be higher than in less exact forms of engineering.

The committee expresses concern at the acute shortage of scientific and technical men and in adequately qualified staffs in all grades of management. Men of high academic, scientific or technical attainments, says the paper, should not be absorbed in the fighting forces where, even when they are employed in technical jobs, their qualifications are often much higher than is needed. It also recommends more pre- and post-graduate courses in aeronautics at the universities, especially as peacetime facilities for training in the industry are now used for training R.A.F. personnel. The appropriate departments should investigate the facilities available to determine what action is necessary.

Little appears to have been done to remedy the deficiency in qualified management staffs, and comment is made upon the frequent reluctance shown by foremen to accept promotion and increased responsibilty. Courses should be provided to train foremen for higher grades, and more use should be made of the existing Ministry of Labour courses in foremanship.

On the question of sub-contracting, which represents some 42 per cent. of the construction and assembly work, the Committee reports that main contractors, who rely on their own resources for finding sub-contracting capacity, are now having to place sub-contracts with unsuitable firms whom they would not normally employ, with unsatisfactory results. This shows the weaknesses of the present system. But the Ministry of Aircraft Production, and the Ministry of Production, offer facilities for obtaining suitable capacity over a wider field, and these Ministries should take action to ensure that main aircraft contractors make fuller use of these services; at present they only refer to them in cases of exceptional difficulty. Help is also available to sub-contractors through the Regional Organisation of the department, and this fact should be made more widely known to them.

No Labour Shortage

On the labour question, the Committee reports that it found little evidence of actual shortage and no firm complained it was unable to carry out its present programme through shortage of labour. "And it is significant," it adds, "that last year, when the Ministry of Labour withdrew for service in the Forces tens of thousands of young men in semi-skilled categories, employers only asked for substitutes for half the number withdrawn." It agreed, however, that as the programme mounts, and with the possibility of further demands from the Forces, it will become increasingly difficult to obtain sufficient labour.

Aircraft firms had criticised the Man-Power Boards because, though they would give deferrment to the relatively few workpeople with exceptional skill, were less reasonable in dealing with storekeepers, clerical workers and others who were key men and irreplacable because of their experience even if they were not possessed of any special technical skill. The Committee therefore recommends that such men, who may occupy vital positions, should be included in the recent amendment permitting deferment to planning and progress clerks and progress chasers. Another criticism was that some Man-Power Boards were much more reasonable than others, and the Committee recommends that periods tests should be made by headquarters of the way in which these boards are functioning with a view to eliminating inequalities of treatment.

The need for better personnel management to reduce what is at present a serious wastage of labour, particularly among women workers, is emphasised by the Committee. Excessive earnings, confined to a few firms mainly in one area, are also having a serious affect upon production, though probably they are not so great as is commonly supposed. The cause is held

BALANCED AICRRAFT PRODUCTION

to be excessive piece rates, fixed before sufficient experience with the job had been gained, which cannot be varied except by agreement. The Committee recommends, therefore, that the Ministry of Labour should instigate the proper negotiations to review excessive piece-rates and bring them into line with those ruling in the rest of the industry.

Summary of Recommendation

(1) When large changes of programme are under consideration, greater use should be made of the collective advice of the manufacturers concerned.

(2) The problem of reducing the loss of output which is caused by the change-over from an old to a new type should continue to receive attention.

(3) The Department should consider how the frequency of changes in delivery programmes could be reduced.

(4) Closer attention should be given to the cumulative effect of a number of modifications of type.

(5) The situation created by dispersal should be reviewed, and consideration should be given to the possibility of eliminating some of the more inefficient units and to concentrating capacity in fewer, less scattered and more economical units.

(6) Capacity released as a result of the reorganisation of the engine shadow industry should be put to other uses without delay, whether on behalf of the Ministry of Aircraft Production or another Supply Department.

(7) The possibility of making undercarriages an item of embodiment loan should be kept in mind, and, as soon as the degree of stabilisation permits, this question should be reopened.

(8) The Department should take action to ensure that standardisation of undercarriage parts and equipment is pressed forward more vigorously.

(9) The Department should take every possible step to stimulate spares production.

(10) When it is proposed to extend capacity for a type already in production, full consideration should be given to the possibility of segregating the whole or a part of the spares production in a separate factory.

(11) The Ministry of Aircraft Production and the Air Ministry should ensure that contractors submit lists of minor parts required as spares without delay, and should consider them promptly.

(12) An enquiry should be made to ascertain whether the system of ordering spares urgently required for grounded aircraft is working properly.

(13) The Department should give attention to the need for strengthening design staffs by the appointment of draughtsmen with actual experience of production engineering, and to the importance of arranging that design and development offices and planning departments are within the same premises and housed as close to each other as possible.

(14) More appointments similar to that of the Technical Adviser to the Chief Executive should be made.

(15) The appropriate Departments should investigate the facilities available for training research workers, aeronautical engineers and other technicians in order to determine what action is necessary to meet requirements.

(16) Courses should be provided to train foremen for higher grades, and more use should be made of the Ministry of Labour's courses in foremanship.

(17) The Ministry of Aircraft Production and the Ministry of Production should take action to ensure that main aircraft contractors in search of capacity make fuller use of the services which these Departments offer.

(18) It should be made more widely known to sub-contractors that when in difficulties they can get help from the Regional Organisation of the Ministry of Aircraft Production.

(19) The allocation of sub-contracts should be reviewed by the Ministry of Aircraft Production in co-operation with the Ministry of Production in order to eliminate the disadvantages arising from the haphazard distribution of many small orders and thus to secure longer runs of production; and the process of reducing the number of sub-contractors engaged on the same component and the number of different components made by the same sub-contractor should be expedited and extended.

(20) Rate-fixers, clerical workers and storekeepers, who posses superior qualifications or specialised knowledge and who undertake the more reponsible duties, should be regarded as eligible for deferment if they occupy key positions; and the Ministry of Labour's instructions to Man-Power Officers should be amended accordingly.

(21) Periodic tests should be made by the headquarters of the Ministry of Labour of the way in which the Man-Power Boards are functioning with a view to eliminating any inequalities in their treatment of deferment cases.

(22) The Ministries of Labour and Aircraft Production should take steps to reduce the wastage of labour from aircraft factories, particularly by way of better personnel management.

(23) The Ministry of Labour should institute negotiations between the national representatives of the employers and workpeople in the aircraft industry to review excessive piece-rates and bring them into line with the rates current in the rest of the industry.

(24) The process of price-fixing should be shortened and the price should be fixed at the earliest possible stage of production.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Who's Who

LUFTWAFFE units operating in the southern sector of the Russian front, in the area of Taganrog and the river Mius, are, according to enemy reports, commanded by General der Flieger Dessloch.

Death of Latécoère

THE death in Paris is reported of Jean Latécoère, the French aircraft constructor. He took a prominent part in the development of Air France routes to Morocco, Senegal, and South America.

A.R.P.

THE shortage of man-power and the pressing need for expansion of the A.R.P. services forces the Germans to make an increasing use of their boy-power. In addition to the employment of boys in the *Luftwaffe* A.A. batteries, more than 300,000 members of the Hitler Youth Organisation are reported to be in the fire-fighting service. They are recruited by order of the police and the minimum age is fifteen.

Luftwaffe Loss

GERMAN radio reports that Air Marshal von Witzendorff, chief of the central department in the German Air Ministry, died after a stroke. Another loss sustained by the *Luftwaffe* is Major General V. Chamier-Glisczinski, who is reported to have met with a fatal accident, details of which are not stated.

Up-to-date Russians

COMMENTING upon the air fighting on the Russian front, a Finnish report gives the following revealing picture:—

"Older types of Russian aircraft have begun to disappear, and new types with better equipment, such as the Lagg-5, the Yak-1, and the Yak-7, have been put into service.

"Russian material has on the whole not deteriorated, but rather, it can be said, improved. British and American aircraft which were fairly frequent some time ago are giving place more and more to Russian types. The Lagg-5 fighter is perhaps the most difficult aircraft to get at."

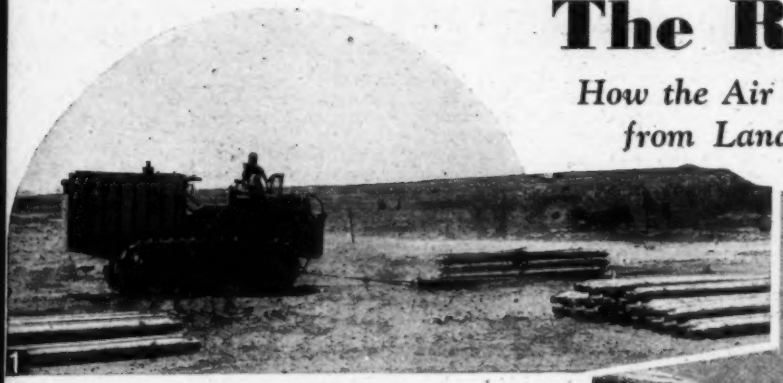
Aircraft v. Guerillas

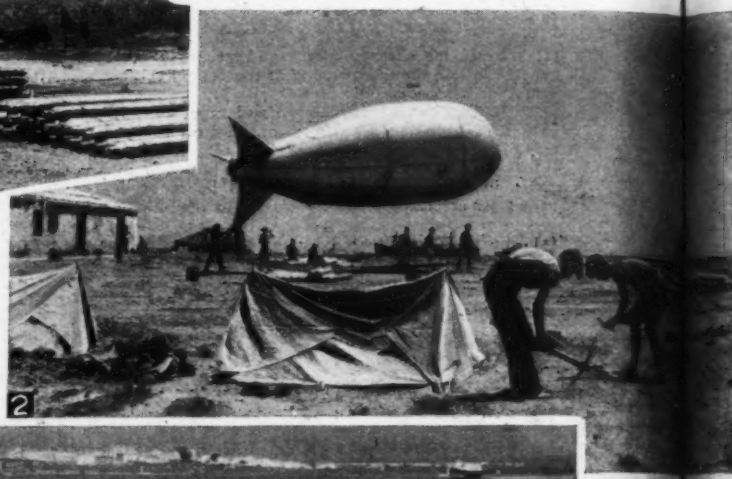
OFFICIAL Italian information discloses that units of the *Regia Aeronautica* stationed in the Balkans are engaged in almost continuous fighting against Yugoslav patriots. Reconnaissance aircraft bombers and fighters are used in these operations and transport aircraft are frequently employed to supply troops by air and to maintain contact between garrisons which run the risk of being isolated.

The report says that bombers are particularly effective against "villages which have become rebel strongholds," whilst the intervention of fighters is especially decisive as they engage the guerilla forces themselves in the narrow valleys where ground troops could act only with difficulty.

The R.A.F. Dig In

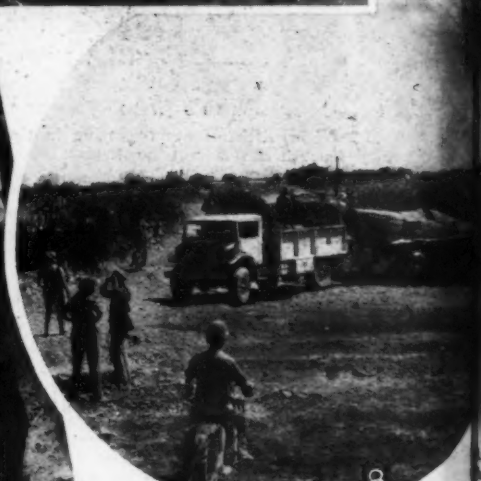
How the Air Forces Set Up Air Cover from Landing Grounds on Sicily





1. A tractor towing cylinders of hydrogen on an improvised sledge.
2. A R.A.F. barrage balloon site on the Sicilian beach. Extensive barrages had to be set up in case the *Luftwaffe* tried dive-bombing in force.
4. Time was when the Spitfire was considered to be suitable only as a metropolitan fighter. To-day sees even the latest Mark IX Spits with two-stage blower Merlin 61 engines in the vanguard of an invading air force.

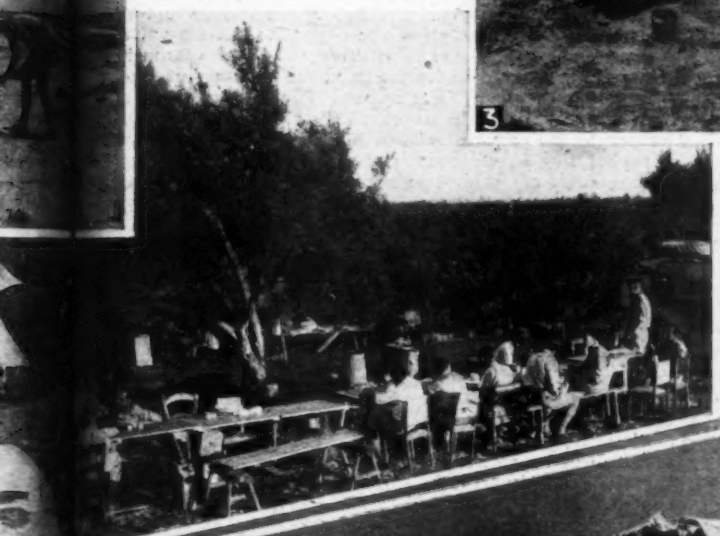
7. It shows a certain expectation of success when the squadron includes its library in its invasion essentials.



8. A Spitfire of a South African squadron being serviced on the perimeter of a captured Sicilian airfield.

IN our previous issue we published a series of photographs showing R.A.F. activities in the very early hours of the invasion of Sicily. On these two pages is shown the establishment of a balloon barrage and a Spitfire IX fighter station on this first invasion of enemy territory. Although the last of the Axis troops were chased off the island in 39 days, it is certain that Sicily will be an Allied air base for a long while to come.

3. Spreading a barrage balloon on the sandy beach ready for inflation



5. An *al fresco* officers' mess in the citrus orchards of Sicily. Since the flies cannot be seen in the photograph it all looks very pleasant.

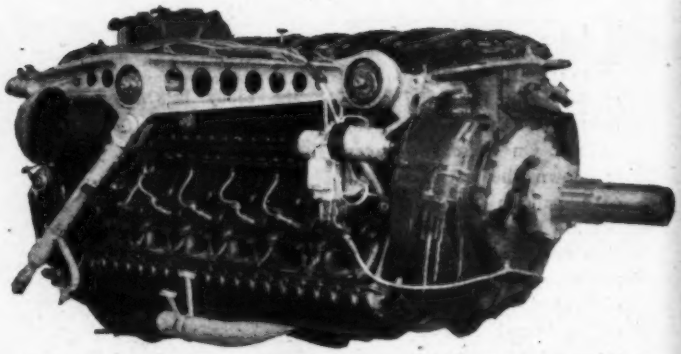
6. The new owners put up their name-plate for all to see.

Unloading fins and tails of barrage balloons from a lorry on the beach.

Wrecked hangars and Axis aircraft, found en the R.A.F. moved into Comiso airfield. stematic bombing by aircraft of the R.A.F. and U.S.A.A.F. of the Sicilian airfields played large part in making possible the successful asion of the island. Comiso airfield received one week more than 600 tons of bombs.

The Junkers Jumo 211 Series

Captured Heinkel He IIIH and Junkers Ju 88A.1 Power Plants Examined



The engine mounting is of magnesium alloy forgings supported by tubular steel struts.

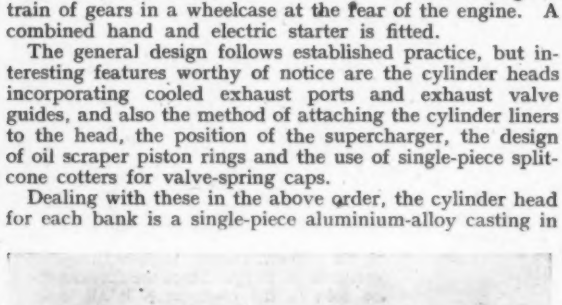
ILLUSTRATED descriptions of the German Jumo 211A aircraft engine have previously appeared in *Flight*, the most important being a detailed and fully illustrated description of the main feature of interest, viz., direct-fuel injection, in our issue dated January 18th, 1940.

In our issue of August 5th, 1943, we published brief results of bench tests which the Ministry of Aircraft Production has had made on Jumo 211D engines taken from a Heinkel He 111. Following is an abstract from M.A.P. reports on the engine.

The 211A engine, fitted with a two-speed supercharger, has 12 cylinders, arranged in inverted-Vee formation, and is liquid-cooled (Glysantin-water mixture), with direct-fuel injection into the cylinders and spark ignition. The airscrew is driven through spur reduction gearing, both the driving and driven gears being splined to the shafts and centralised by split bronze cones. The driven shaft is mounted on a roller race at the rear and on a combined roller and thrust race at the front housing cover. Provision is made for a cannon firing through the airscrew shaft. Auxiliaries and accessories are driven through a train of gears in a wheelcase at the rear of the engine. A combined hand and electric starter is fitted.

The general design follows established practice, but interesting features worthy of notice are the cylinder heads incorporating cooled exhaust ports and exhaust valve guides, and also the method of attaching the cylinder liners to the head, the position of the supercharger, the design of oil scraper piston rings and the use of single-piece split-cone cotters for valve-spring caps.

Dealing with these in the above order, the cylinder head for each bank is a single-piece aluminium-alloy casting in which the camshaft bearing pedestals are cast integrally. The combustion chambers are flat-topped and have two inlet and one exhaust valve per cylinder. Bronze valve guides are inserted; the exhaust valve guide passes through the water space and is a press fit in the opening into the combustion chamber. The pressure joint is made on an aluminium washer under the shoulder of the guide. Water leakage at the camshaft end of the guide is prevented by a rubber ring in an annular groove. The steel valve-seating rings are conical externally and are pressed into the head and rolled into a taper at the inner end; the exhaust-valve rings appear to be "Stellite"-faced.



Cooling the exhaust. The exhaust port is completely jacketed, and cored passages are provided around the exhaust-valve guide.

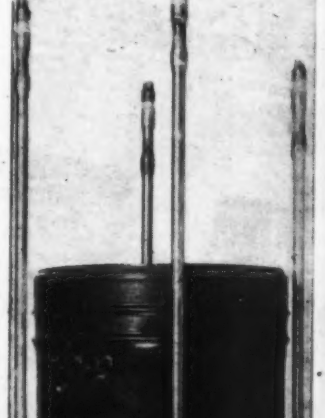
Provision for Four Plugs

Two sparking-plug holes are provided on each side of the cylinder head, although two plugs only are fitted. The fuel-injection nozzle is situated on the centre line, at right angles to the crankshaft. The nozzle is screwed into the cylinder head and is liquid-cooled.

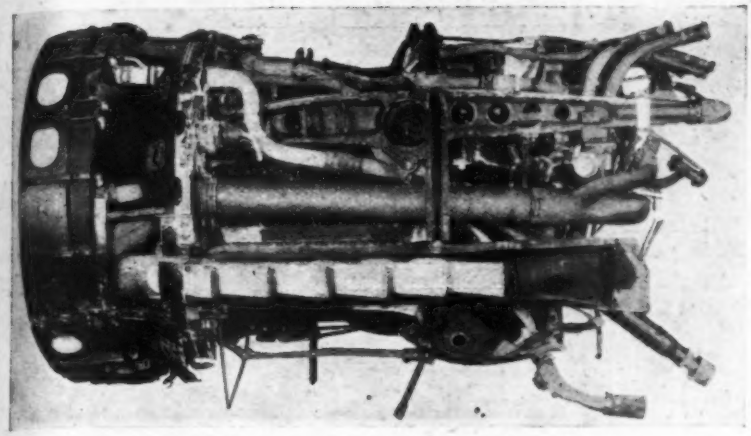
The intricate nature of the cylinder-head casting is illustrated, and its will be noticed that the exhaust port is completely jacketed, and that cored passages are provided around the exhaust-valve guide and injection nozzle. Preliminary examination of the casting suggests that it is of good quality and that considerable skill is necessary for its manufacture.

Liners of 45-ton steel are bolted to the cylinder head by four long studs of 60-ton steel, the head itself being secured to the cylinder block by fourteen studs.

The engine is fitted with a two-speed centrifugal supercharger, the air intake of which faces forward and is protected only by a gauze screen. An un-



Cylinder liner. Four long studs draw the liner against the cylinder head into which the liner is spigoted.



Jumo 211. The oil cooler and coolant radiators are built as an annulus at the front of the engine in the Ju 88A.1 installation. The air flow is controlled by gills.

JUNKERS JUMO 211A ENGINE

Cooling	Liquid 40 per cent. Glysantin, 60 per cent. water.
No. of cylinders	12
Disposition of cylinders	Inverted 60 deg. Vee; 6 cylinders in line.
Bore 150 mm.	Stroke 165 mm.
Compression ratio	6.57 to 1.
Swept volumn (total)	35.1 litres (2140 cu. ins.).
Direction of rotation, crankshaft ...	Left hand.
Direction of rotation, airscrew ...	Right hand.
Airscrew reduction gear type ...	Spur gear.
Airscrew reduction gear ratio ...	31 to 20.
Supercharger type	Centrifugal.
Supercharger drive	Bevel gear from crankshaft and Ortlinghaus clutch two speed gear.
Supercharger gear ratios	1 to 7.95 and 1 to 11.375.
Weights, Engine and main engine parts. Engine, oily before stripping, with fuel pump, magnetos and airscrew shaft and sparking plugs	1453 lb.
Weight of engine mounting, comprising two magnesium forgings, tubular struts, ball ends and attachment plates for engine	96 lb.

usual feature of this unit is the transverse mounting of the supercharger, which is located by two dowels and fixed with a single ring nut. The impeller is of the usual Junkers spout type of construction, and the diffuser is without vanes. The shaft is carried on hardened-steel bushes which rotate in self-aligning aluminium-alloy bearings.

Unusual Scraper Rings

The two-speed gear is housed in the auxiliaries gear box and is driven by a bevel gear, which is coupled by a splined shaft to the crankshaft. Examination of the pistons reveal that they are of aluminium alloy, with slightly dished crowns ribbed on the inside. Three gas rings and two scraper rings are fitted, one of the latter being above the gudgeon pin; oil return holes are drilled behind and below these rings. As mentioned, the scraper rings are of unusual design, being chamfered on the combustion-chamber side to approximately half-ring thickness. On the crankcase side the ring is undercut with a vee groove arranged so that a knife-edge is presented to the oil film on the outward stroke (towards crankshaft) of the piston.

Both inlet and exhaust valves are of normal design and slightly recessed on the upper faces. Exhaust valves are sodium cooled in the stem and have "Stellited" faces, and are made of austenitic steel. Inlet valves have 30 deg. seat, whilst exhaust valves have seats at 45 deg.

Two springs are fitted to each valve, and calculation indicates maximum stresses in the inner and outer springs of 64,000 and 68,000 lb./sq. in. respectively. The unusual feature of the taper cone cotters is that they are made in one piece, split at one side and grooved down the other. The probable advantage of this design is that the spring load on the stem is more evenly distributed with these cotters than with the normal split cotter.

A further unusual feature is to be found in the design of the crankshaft, in which all webs are in the form of flat plates and are extended to form balance weights, the shape of the pair of webs on each side of each main bearing being similar. The crankshaft receives a supply of lubricating oil through a sleeve at the front end, and all bearings are lubricated through holes drilled in the journals and crankpins. Short tubes are fitted in each oil hole, which, in addition to preventing sludge entering the bearing, may be intended to act as bushes to reduce the stresses in the shaft around the holes.

Apart from the items mentioned, the design follows more or less established practice; the castings are of high quality throughout, several being of magnesium alloy, and all parts are well made and highly finished. The weight of the engine is low in proportion to the swept volume, 1,450 lb. and 35 litres respectively, but on account of the relatively low maximum engine speed the power output per litre is also low. Fuel oil, coolant, hydraulic and air pipes are individually marked in accordance with a colour code, and bulkhead connections are numbered to assist installation.

Forged Engine Mounting

The engine mounting, of typical German design, consists of two single-piece magnesium alloy forgings attached to the engine at two points on each side and supported by a steel tubular strut under each rear point of attachment.

Bearer plates are bolted and dowelled to the sides of the engine crankcase, and connected to the cantilever mounting through flexible rubber bushes.

The mounting is attached to the nacelle by four "union" type nuts, thus rendering removal of the engine, complete with mounting, extremely easy.

The engine and oil cooling systems do not call for any special comment, and in view of the full description already given in a previous issue of *Flight* relating to the direct fuel-injection system this need not be referred to again here. The description so far relates to an examination of the Jumo 211A as installed in the Heinkel He 111H aircraft.

Following the strip examination of the above engine superficial examinations of the Jumo 211A (3) and 211D (1) engines have been made and, in addition, the Jumo 211B (1) type, as installed in the Junkers Ju 88A.1 aircraft. Certain modifications have been embodied in the later series which are summarised in the table, with corresponding details of the original 211A (1) engine. Such

JUMO 211A SUPERCHARGER

Data at maximum engine speed of 2300 r.p.m.—	
Impeller tip speed in high gear (11.375 x crankshaft speed)	1080 ft./sec.
Impeller tip speed in low gear (7.95 x crankshaft speed) ...	746 ft./sec.
Number of impeller spouts	14
Total flow area at impeller tip	13.02 sq. in.
Total flow area at impeller eye	18.8 sq. in.
Impeller tip diameter	9.45 ins.
Entry guide blade tip diameter	5.79 ins.
Entry guide blade root diameter	2.36 ins.
Under take-off conditions (1200 b.h.p., 2300 r.p.m.) :—	
Axial velocity at eye	176 ft./sec.
Velocity of entry guide blades at mean diameter	322 ft./sec.
Angle of entry guide blades to tangential direction at mean diameter :—	
Theoretical	29 deg.
Measured	31 deg. ± 3 deg.
Estimated maximum pressure ratio at ground level, 2300 r.p.m. in high gear is between 2.0 to 1 and 2.1 to 1.	
Area of mouth of air intake (gross)	82.0 sq. in.

THE JUNKERS JUMO 211 SERIES

modifications have been designed primarily to overcome operational faults and to improve control, but in the case of the 211D (1) engine it will be noted the maximum crankshaft speed has been increased.

It is interesting to note also that fuel recovered from the first two engine installations was of 88 octane. That from the 211D (1), on the other hand, was a high-quality spirit of 91.5 octane.

The 211B (1) series engines examined from the Ju 88A.1 aircraft are, in general, similar to the 211A type previously described. Modifications to the installation in this aircraft, however, differ considerably from the Heinkel 111H.

New Modifications

A brief summary of these modifications is as follows:—

A barometric capsule-operated automatic two-speed gear change is fitted to the supercharger to engage low gear below about 10,000ft. This modification prevents, by overriding the pilot's control, the use of the high-speed gear below a safe altitude. The injection-pump fuel-control limit is fitted with a second capsule to correct the fuel delivery for varying exhaust back pressures, and so maintain a more consistent mixture strength.

The oil cooler and coolant radiators are built as an annulus round the header tank at the front of the engine, the cooling air flow being controlled by gills operated by crank and sprocket mechanism attached to each and driven by an endless chain from a small high-speed (14,000 r.p.m. for 15 seconds) Siemens motor controlled by the pilot. This provides an extremely compact installation, dispensing with the hydraulically operated retracting radiator as fitted in the Heinkel 111H aircraft.

Electrically driven immersed pumps are fitted in the fuel tanks, and jettisoning is effected by use of the superchargers, while de-icing of the wing leading-edges is provided by heat from the exhaust system. Improved types of hydraulic and vacuum pumps are fitted, the latter operating Goodrich-type de-icing bags on the tailplane.

The same high standard of workmanship and attention to detail shown in the previous engines examined is apparent in the 211B (1), but the compact installation would require skilful planning for quick production, and certain of the controls are by no means conveniently situated.

Data relating to the engine, supercharger and also the weight analysis for the complete installation on the Ju 88A.1 are given in the accompanying tables.

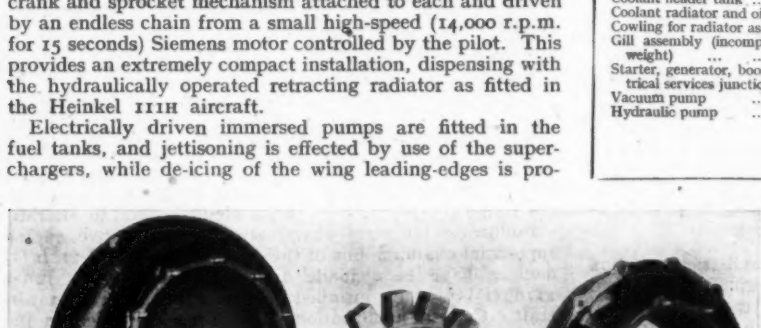
In a description of the engine in *Flight* of November 16th, 1939, it was stated that width and length are about 80in. and 67in. respectively, and in general design the engine resembled the Jumo 210. At the time it was known that at 13,800ft. a

SUMMARY OF MODIFICATIONS TO LATER TYPES.

Detail	211A (1) engine	Modifications.	
		211A (3) engine	211D (1) engine
R.P.M. Max. for peak power as indicated on engine data plate ...	2,200	2,200	2,400
Fuel: octane No. referred to C.F.R. engine	88	88	91.5
De-aerator	Fitted on rear of engine	Fitted on injection pump and considerably modified	Similar to 211A (3)
Injection pump controls	One Bowden type cable for slow running mixture adjustment wired immovably after setting to fixed throttle back-plate, and connected on pump to the mixture control worm spindle	One Bowden type cable wired to throttle as in 211A (1). A second cable from worm spindle interconnects with fuel filter selector	Similar to 211A (3)
Magnetos	Two Bosch Type SE.12.BRS. with booster coil and auxiliary retard contact breaker	Similar to 211A (1)	Similar to 211A (1), but with the retarded contact breaker automatically brought into action also on slow running
Supercharger	Centrifugal, with two-speed gear with hand operated mechanical change gear mechanism. Ratios:— 11,375 and 7.95	Similar to 211A (1)	Similar to 211A (1) but with change speed mechanism hand operated through hydraulic servo
Oil cooler	Honeycomb	Similar to 211A (1)	Similar to 211A (1) but with larger capacity
Injection pump	Junkers 12 cyl. V Type	Similar to 211A (1) but with plunger stroke increased by 0.010in.	Similar to 211A (3) but with control unit modified for back pressure correction

JUMO 211 B.1 WEIGHT ANALYSIS
As Installed in Ju 88A.1 Aircraft

	lb.	oz.
Engine only, with main engine parts, airscrew shaft and plugs, etc.	1605	14
Exhaust manifold (port)	33	0
Exhaust manifold and boiler (starboard)	39	12
Exhaust manifold cowling	30	0
Engine bearers (2)	90	0
Coolant header tank	15	0
Coolant radiator and oil cooler assembly	280	0
Cowling for radiator assembly	24	0
Gill assembly (incomplete by approx. 20 per cent. by weight)	77	8
Starter, generator, booster coil, V.P. airscrew motor electrical services junction box, electric leads, etc.	95	8
Vacuum pump	4	0
Hydraulic pump	5	6
Total weight ...	2300	0



Supercharger. Details of the supercharger. The impeller is of the usual Junkers spout-type construction.

maximum power of 975 h.p. was available for five minutes at 2,300 r.p.m., and that the Junkers company quoted a power of 1,200 h.p. for the then latest Jumo 211, which undoubtedly was a take-off rating.

It may be recalled that, as recorded in our article in the August 5th issue, the bench tests carried out on behalf of the Ministry of Aircraft Production indicated a maximum take-off power, for the 211D, of 1,160 b.h.p. at 2,400 r.p.m., and 4.7 lb./sq. in. boost.

Crankshaft. All webs are in the form of flat plates and extended to form balance weights.

Aeronautical Technical Training

Growing Support for Improved Facilities

THE keen interest that *Flight* and its associated monthly journal, *Aircraft Production*, have consistently taken in pressing for an extension of the facilities available for the advanced technical training of aircraft engineers is well known. Improved and wider research facilities, larger modern wind tunnels, and study of works production technique have been among our aims. The idea of a national university of aeronautics for post-graduate students was discussed in these columns early in the year, and national publicity was accorded to the project as a result of a letter to the *Daily Telegraph* on May 7th from the Managing Editor of *Flight*, who extended a proposal advanced by Mr. F. G. Miles. Since that time a great deal of influential support for the campaign has been forthcoming, and a further letter, which appeared in the *Daily Telegraph* on Friday, August 20th, briefly reviews progress achieved. A copy of the letter is appended:—

Sir,—On May 7th you published a letter from me in which the possibility of the Government sponsoring a National University of Aeronautics was broached, and you supported the plea in a leading article.

In the letter it was stressed that the dearth of facilities available to aspirants for technical positions in aircraft engineering and for specialised technical education in the science of aeronautics was a serious educational deficiency, to which problem Mr. F. G. Miles had drawn attention. The burden of the plea was to bring under one roof all the sciences and branches of engineering and technology directly or indirectly connected with aircraft problems.

Correspondence followed my letter, and it seemed to be acknowledged that chairs of aviation at three universities were not enough in view of the importance of the subject to our future national well-being. Subsequently the Royal Aeronautical Society arranged two public discussions (which, by the way, were well attended). Many interesting views were put forward by the leaders in the industry, by educational authorities and by students and associates, and the common view emerged that a central institution for the training of aeronautical engineers would go a long way towards meeting a real need.

Not all are agreed, however, that a separate University of Aeronautics is called for, though it does seem to be fairly generally agreed that post-graduate students need lavish research facilities and access particularly to larger wind tunnels to cope with the enlarged size of modern aircraft. There is agreement also, as urged in my original letter, that production techniques should form part of aeronautical training.

As a result of this campaign and its powerful reinforcement in the House of Lords last month by the Earl of Listowel, who drew attention to notes on the subject by the Society of British Aircraft Constructors, the Paymaster-General, Lord Cherwell, announced a move on the part of the Government.

They had asked the Aeronautical Research Committee to explore the possibility of founding a school of aeronautical science, which would have a convenient airfield, with all the equipment and facilities involved, and close enough to one of the great existing research centres for students to be associated with work requiring the most elaborate equipment in the country. The school was to be as free from bureaucratic control as were the universities, and it was hoped to explore, with the Governments of the Commonwealth and the Empire, the possibility of making the proposed institution a great Imperial venture.

The result of the deliberations of the Aeronautical Research Committee is not yet available, but the report of the Select Committee on National Expenditure (Aircraft Production), before which I had the honour of laying evidence, surely constitutes a timely cue for immediate Government action.

This White Paper emphasises the acute shortage of scientific and technical personnel and relates the dearth to the entire industry, including existing official establishments and the whole field of aeronautical research. No more striking confirmation of the situation it is sought to remedy has yet appeared.—Yours faithfully,

G. GEOFFREY SMITH,
Managing Editor of *Flight*.

Dorset House, S.E.1.

"FLIGHT" INDEX

Copies of the index to *Flight*, January to June, 1943, will be ready shortly, price 1s., or by post 1s. 1½d. With cloth binding cases 4s. 6d. and 4s. 11d. respectively.

BOOK REVIEW

"Lathe Work"—A Practical Hand Book for Lathe Operators.

AT the present time when large numbers of new people, both male and female, are entering the engineering industry, their training becomes a serious problem. To become efficient operators this unskilled labour requires more tuition than that normally given in the workshop, as this usually consists only of instruction in one particular job. One solution to this difficulty lies in encouragement to read suitable technical literature, but, unfortunately, it is rather difficult to find books of a sufficiently elementary nature for this type of person.

Appreciating this, Saunders Roe, Ltd., produced a pocket size reference book for the use of their lathe operators. It is written in simple language and well illustrated with explanatory sketches. The various parts of different types of lathes are described in a detailed manner, and many "do's and don'ts" hints are given. Chucks, centres, steadies, tools, screwing heads, sketches and measuring instruments are covered, and the turning of a typical job in each type of lathe is described in detail. At the back of the book is a dictionary of unfamiliar technical words and also several pages of useful data. The Parliamentary Secretary to the Ministry of Aircraft Production and Sir Wilfrid Rhodes Freeman, K.C.B., C.B., D.S.O., M.C., have stated their approval of this book, and the M.A.P. have brought it to the notice of certain of their contractors.

In view of the success of this book in their own factories, Saunders Roe, Ltd., have decided to make it available to other engineering firms, and have agreed to forfeit all copyright fees from the sale of the book in favour of the R.A.F. Benevolent Fund. The price of the book is governed by the quantity ordered, e.g., stiff bound copies ordered in minimum quantities of 1,000 copies cost 2s. 3d. Orders for more than 100 but less than 1,000 can be supplied with the purchaser's name on the cover at slightly extra cost. Details can be obtained from The Press at Coombelands, Ltd., Addlestone, Surrey.

Sixty-third of the Latest Recognition Series

Aircraft Types and

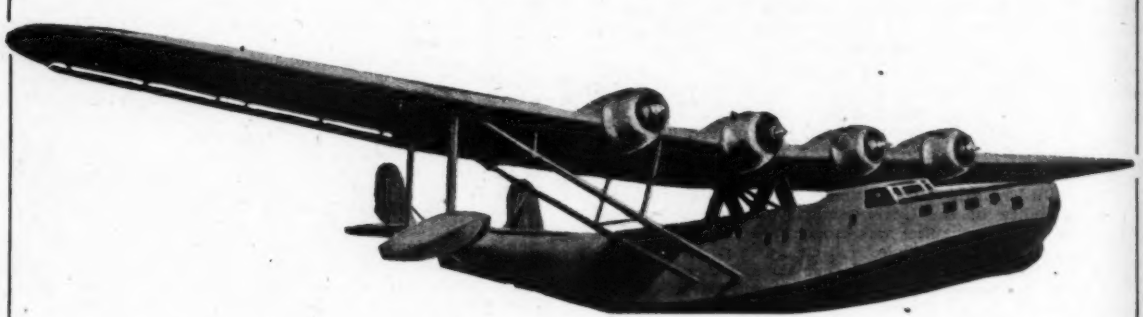
KAWANISHI T.97

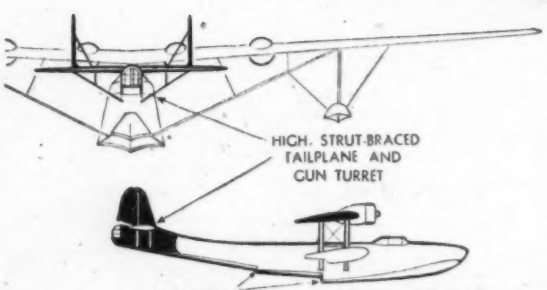
THIS is considerably the larger of the Japanese Navy's two four-engined flying boats, and is a development of the Kawasaki flying boat put into service on the Yokohama-Saipan service, this in its turn being developed from the Sikorsky S-42-B.

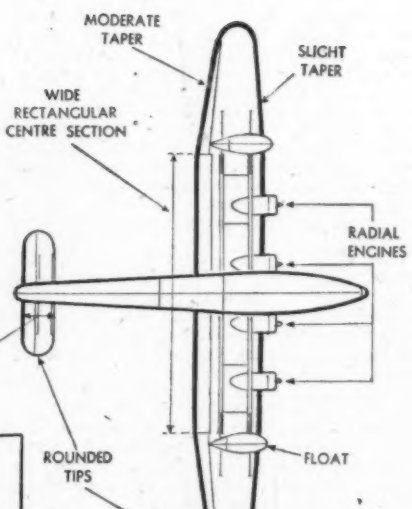
Primarily intended for sea reconnaissance duties, the Kawanishi T.97 has frequently been used during the present war for bombing, and it can also be used as a torpedo-bomber. It is powered by four Kinsei 14-cylinder, double-row air-cooled radial engines which are rated at 900 h.p. at 13,000ft., at which altitude the Jap aircraft has a top speed of 215 m.p.h. and a cruising speed of 165 m.p.h. Its service ceiling is 26,000ft. and its maximum range about 1,500 miles, or approximately nine hours. Normal tankage accommodates 1,500 gallons of fuel, but it has an estimated maximum tankage of 1,950 gallons. Its normal flying weight is 45,000 lb., and it carries a crew of ten men. A maximum bomb load of 3,500 lb. can be carried at the expense of reducing the cruising range to 1,450 miles.

Armament of the earlier versions of the T.97 comprised either 7.7 mm. machine guns or a 20 mm. cannon in the nose, and 7.7 mm. machine guns in a dorsal turret aft of the wing. Later versions, however, have swapped the dorsal turret for a tail turret.

From a head-on view the T.97 has a wide, thin wing, strut-braced to the side of the hull just above the first step, and a slight dihedral from the point of its attachment to the inverted "V" centre-section struts. In plan the centre-section of the wing is seen to extend with parallel edges to the point of attachment of the pairs of parallel main struts, which is almost to the stabilising floats. The comparatively short outer panels taper moderately on their trailing-edges and very slightly on their leading-edges, the tips being rounded. The small tailplane has parallel edges and rounded tips, and is braced by parallel struts.







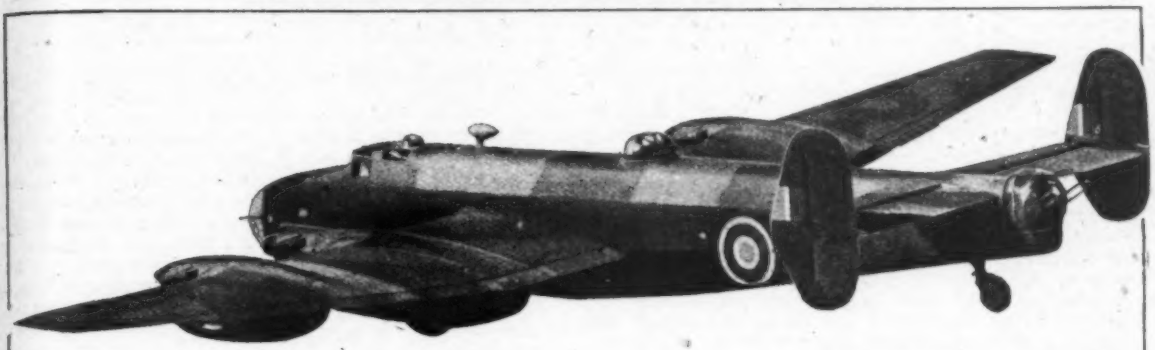
DIMENSIONS

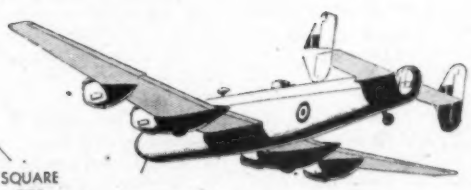
Span	*131ft.*
Length	*81ft.*
Height	*20ft. 6in.*
Wing area	*1,900 sq. ft.*

FLIGHT copyright

Their Characteristics

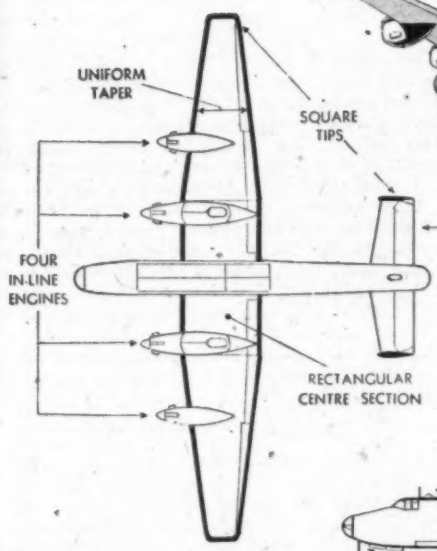
HANDLEY-PAGE HALIFAX II Series Ia

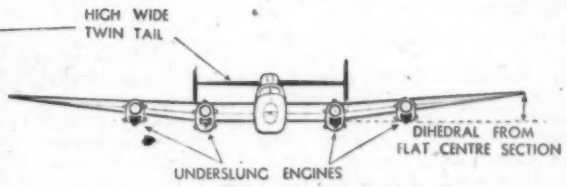


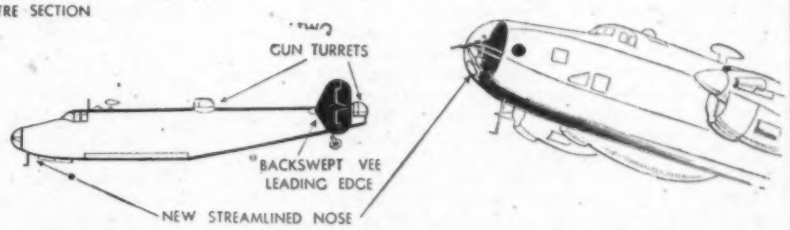


DIMENSIONS

Span	*99ft.*
Length	*70ft.*
Height	*21ft.*
Wing area ..	*1,250 sq. ft.*







IMPROVED bombing tactics and the need for greater speed has had its reflection in recent modifications to the detail design of the Handley-Page Halifax which have changed some of its recognition features.

It has been found that for night operations a nose turret is no longer really necessary, and that the gain in speed consequent upon the reduction in drag achieved by doing away with the nose turret is a distinct advantage.

The first change, which produced the Halifax II Series I, was the substitution of a blacked-in nose in place of the turret, thus presenting a rounded streamlined "entry" instead of the familiar "chin" of the Halifax I. A rounded bomb-aimer's panel was let into the underside of this new nose, and some of this version are in service without even dorsal armament, only the tail turret being retained.

This version, however, proved to be only an intermediate stage, for it has quickly been followed by the Halifax II Series Ia, on which a streamlined Perspex nose, containing a Vickers K gun on a flexible mounting, has supplanted the blacked-in type, and this is the version illustrated.

Yet another improvement in the Ia version is the substitution of a Boulton Paul four-gun power-operated dorsal turret for the two-gun turret fitted to the Mark I Halifax. This has not only strengthened the fire-power from this position, but it has reduced drag still further.

Other modifications of, perhaps, a minor character so far as practical recognition is concerned, are the abandonment of the fuel jettison pipes which previously protruded from the trailing-edge of the wings, and better streamlined engine nacelles, the inner pair of which now project slightly beyond the trailing-edge on the latest examples; this is shown in the small perspective sketch above.

The Halifax II is powered by Rolls-Royce Merlin XXII engines each developing 1,280 h.p., and its top speed in operational trim is now officially stated to be 261 m.p.h. at 19,500ft.

Theories of Air Power

An American Analysis

By MAJOR F. A. de V. ROBERTSON, V.D.

"AIR power revolutionises in many respects, but does not necessarily outmode, older concepts of warfare. It lengthens our reach . . . but does not change the basic principles of warfare." Gen. E. P. Sorensen, Assistant Chief of Staff, U.S.A.A.F. Intelligence.

A FEW weeks ago an article in these columns tried to set forth American ideas on the use of air power as expounded by Maj. Gen. Eaker, the officer commanding the U.S. Army Eighth Air Force in the United Kingdom. There has now come to hand an analysis of the theories of air power by Gen. E. P. Sorensen, Assistant Chief of Army Air Force Intelligence, contained in an address which he delivered in June to the Society of Mechanical Engineers at Los Angeles. It is an extremely thoughtful address, going deeply into the subject, and it is a gratification to find that Gen. Sorensen is, in the main, in agreement with the ideas set forth in *Flight* both before and during the present war. Only on a few comparatively minor points must we display the temerity to disagree with him.

There were probably not a few of his hearers, and perhaps still more readers, of his address who were surprised at the principles which he laid down. Air power is looming so large in this war, and it is filling so many columns in the newspapers, that not a few superficial thinkers have concluded that the air is the only thing that matters. Gen. Sorensen laid it down at the outset that "Air power revolutionises in many respects, but does not necessarily outmode, older concepts of warfare. It lengthens our reach . . . but it does not change the basic principles of warfare." In other words, aircraft provide a new weapon, just as in past centuries the domestication of the horse and the invention of gunpowder introduced new forms of tactics.

Long-range Artillery

The General went on to give instances of how aircraft have aided armies in the course of the present war. He admitted that part of their functions resembled that of artillery, but emphasised the longer range of the former. That point is surely obvious to everybody, and it is a very important point. But in the development of weapons, as in other spheres of technical advance, an advantage has usually to be paid for. It would do no good service to this newest of all weapons not to recognise its limitations as well as its capabilities. Any given target within the range of guns of suitable calibre can be most effectively dealt with by the artillery. Once a battery has got the range, probably by means of aerial observation, it can open rapid fire from each gun or howitzer until the target is destroyed. The bomber, on the other hand, has to go through a separate sighting operation on each bombing run, and that operation is complicated. The R.A.F. Bomber Command, in fact, working by preference by night, has abandoned the idea of precision bombing and gone in for area bombing.

There have been occasions, especially in the East African campaigns, when the artillery could not keep pace with the infantry in the mountains, and then it was legitimate to use light bombers as field artillery. It is a sound rule, however, to shell everything within range, and reserve bombing for targets which the guns cannot reach.

Gen. Sorensen proceeds to single out the long-range bomber "as the weapon which enables air power to serve as a primary instead of an auxiliary arm. . . . Air force reaches its peak expression in the heavy long-range bombers, which are the only weapons capable of hitting the real sources of mechanised military power." That is very true, and one almost wonders whether Gen. Sorensen does not in his heart of hearts advocate an independent Air Force for the United States, not necessarily on the same lines as the Royal Air Force, but at least comprising the whole body of heavy long-range bombers.

He certainly does not deprecate the utility of an air arm working with an army, but he points out that air superiority over a battlefield is not always enough. He relates how during Gen. Auchinleck's campaign in Libya the R.A.F. maintained superiority over the *Luftwaffe*, but, none the less, the British were driven back to the edge of Alexandria. He says there was something missing, and concludes that the piece that was missing was strategic bombing. Rommel was able to get in his tanks and supplies, and Gen. Sorensen suggests that they ought to have been sunk while on their way on board ship.

Balanced Forces

That theory raises many queries. One thing that was certainly missing to the British forces was heavy armour. The light tanks that they possessed were no match for those of the Germans, and when Sherman tanks appeared on the scene the enemy was defeated in the ground fighting. But Gen. Sorensen would probably reply that that is no answer, as the German tanks ought never to have arrived. One is also impelled to ask if the British (including Dominion) Air Force was correctly used during that campaign. Did it really recognise that it ought to be an arm of the Army or was it too independent? We do not know the answer, but certainly the Prime Minister announced to Parliament after his return from that front that thenceforward the whole Air Force there was to take its orders from the Army authorities, and thereafter the Army, with Generals Alexander and Montgomery to lead, with Sherman tanks to out-gun the Germans, and with a strengthened Air Force at work, went straight ahead to final victory. Whether the change was due chiefly to the Generals and their novel tactics, to the better tanks, to the increased numbers of aircraft, or to the new subordination of the Air Force to the Army—or to a combination of all those factors—is again a question which only future historians will be able to decide.

Bombing Supplies

Let us revert to Gen. Sorensen's theory that what was missing during the Auchinleck campaign was strategic bombing. We will not quarrel with his use of the word "strategic," for it has come to be accepted whenever heavy bombers are used independently of other arms, though, strictly speaking, attempts to interfere with lines of communication, whether by sea or by land, behind the enemy's front would seem properly to be of a tactical nature. In the first instance, the movement of Rommel and his Africa Korps from Europe to Libya does seem to have taken place without much interference from the British, whose eyes were turned towards Greece and Crete. Later on very heavy toll was taken of the ships which set out from the mainland to keep Rommel supplied, though the number which got through was always greater than the number sunk. The attacks on these ships were made by both the Royal Navy (chiefly by submarines) and by torpedo-bombers (some of which were naval Albacores and Swordfish). It is almost certain that the greater part of the sinkings was due to the submarines; but in such an operation Navy and Air Force must work closely together, and no doubt many submarines received the information on which they acted from patrolling aircraft. It was no part of Gen. Sorensen's text to discourse on naval operations. But the stretch of sea between Italy and Sicily on the one hand and the ports of Libya on the other was too great for a blockade to be established by the available

THEORIES OF AIR POWER

naval vessels and aircraft. At the end of the Sicilian campaign the Straits of Messina were too narrow to be blockaded. The happy mean was found at the end of the Tunisian campaign, when the Axis troops could not get away by sea and were captured almost intact. It seems to us that Gen. Sorensen's conclusion that the absence (as he alleges) of strategic bombing was the cause of the British retreat to Alamein over-simplifies a complex matter.

Air Targets

A most interesting section of Gen. Sorensen's address is that in which he analyses the strategic objects at which the use of heavy bombers ought to be directed. In effect, he asks whether the attack ought to be directed against public *moral* or against military targets, and, as one would expect, he comes down heavily on the side of the military targets. He quotes words written by Mr. Churchill in 1917 which prophetically denied that terror-bombing alone could force a major nation to its knees. He might well have quoted Marshal Foch, who some years later expressed the same opinion. He charges Germany with disregarding this principle during the Battle of Britain and the subsequent blitz by night. "If she had been using super-long range cannon to deliver the projectiles," he said, "German tacticians would have insisted, in the interests of efficiency, that the guns be aimed at specific factories, docks and other vitals." Britain of 1943, he says, is proof that Mr. Churchill in 1917 was right.

The motto which Gen. Sorensen holds should guide a bomber force is "economy of effort," and he claims that that motto has for long past inspired the American Air Forces and been the basis for their planning of equipment and technique. We may, we believe, fairly conclude that he meant the American way of bombing by day, using remarkably accurate bomb-sights. It has also been claimed by Gen. Eaker that this method makes for economy, because each bomb produces the maximum effect on the target. Few fall outside it, and the damage to civilians is reduced to an absolute minimum. So far from attempting to strike at civilian *moral*, the Americans claim it as a merit of their method that very few civilians suffer harm from it.

In the same way, it has always been the avowed policy of the British Air Staff to strike at military objectives and not at civilian *moral*. Whereas German pilots have on innumerable occasions machine-gunned civilians in streets and refugees on roads, the British authorities (and the Americans as well) have broadcast warnings to the people in places liable to air attack. These warnings have mainly been addressed to people in friendly territories overrun by the Germans, and it is much to be feared that they were not always able to defy their German taskmasters and take the advice to clear out. There have, however, been warnings to some cities in Italy, and probably they have produced some effect, though the actual fall of the bombs produced much more.

One cannot help the query arising in one's mind whether Gen. Sorensen would, or would not, condemn the methods of R.A.F. Bomber Command as infringing his principle of economy of effort. Early in the war the claim was made that British night-bombers could hit individual buildings, factories and suchlike without laying waste the neighbourhood. Of late, however, the practice of area bombing has avowedly been adopted. It is by no means a policy of terror-bombing, but it accepts as a regrettable necessity that civilians in the neighbourhood must inevitably suffer. Years ago *Flight* set forth the doctrine that a bomb which kills only civilians is a good bomb wasted, and we seem to remember that Mr. Churchill, in the days when he was a voice calling in the wilderness of an apathetic House of Commons, used almost the same words. They are another way of urging economy of effort. At any rate, we British, not being Huns, have no desire at all to kill enemy civilians, though we cannot allow immunity to them at the cost of sparing war factories. British and Americans share the same sentiments as regards the use of bombers, though their methods may differ. Both are agreed that the German ideas and practices are ideally wrong and practically ineffective.

Bombing Stages

Gen. Sorensen concludes his paper by mapping out four stages of strategic bombing, the third being the one "in which we really get down to the business of knocking out the heart of enemy production capacity." The fourth is a clearing-up process. In each of the three first he admits that "there will generally be but little evidence in the front lines of the real effect of strategic bombing." From this we conclude that he allows for the enemy's foresight in having built up a huge reserve of weapons before making war, and that in the early stages of the war he has been able to replace wastage and even increase those reserves. That, we believe, is what the Germans have done, though their need for fighter aircraft has outrun their calculations and provision.

The General's address concludes with the remark: "The invasion should start when to delay longer would waste effort, but when its cost has been reduced to a minimum." That seems to imply that the moment for invading Germany should be related mainly or entirely to the results of the strategic bombing campaign. We submit that other factors need consideration. In the case of this war, the chief drain on German fighting power has been effected by the Russian Army, and the moment for invading Germany must be the earliest possible, so as to bring relief to the Russians. We must hope that when we do invade we may find that our bombing offensive will have deprived the enemy of some of the weapons and materials which he needs.

DEATH OF DR. JOSEPH AMES

WITH the death at Baltimore, Md., on June 24th, of Dr. Joseph Ames, aeronautical science has lost one of its most illustrious figures. Dr. Ames, who would have been 79 years old on July 3rd, was an eminent physicist with a distinguished career lasting close upon half a century. He was at one time president of the John Hopkins University, but it is as an aeronautical research worker that we in Great Britain know and appreciate him best.

Dr. Joseph Sweetman Ames was chairman of the American National Advisory Committee for Aeronautics from 1927 to 1939. He was a member of the N.A.C.A. from 1915 to 1941, having to resign the chairmanship in 1939 on account of failing health. He was appointed to the N.A.C.A. by President Wilson in 1915, and served, in addition to his N.A.C.A. chairmanship, on more than twenty sub-committees without pay. The aeronautical research laboratory at Moffett Field, California, was named after him.

Many were the honours bestowed on this modest and unassuming research worker. In 1923 Dr. Ames read the Wilbur Wright Memorial Lecture before the Royal Aeronautical Society. In that he dealt with the relation between aeronautical research and aircraft design, a subject which is particularly topical at the present time, when the problem of ensuring the production of the best possible aircraft after the war is being widely discussed.

Reference has frequently been made of late to the wonderful aeronautical research being done in America. That this is proceeding along sound and fruitful lines is due in no small degree to the pioneer work done by Dr. Joseph Ames.

Gas Turbines and Jet Propulsion for Aircraft
By G. GEOFFREY SMITH, M.B.E.

A second edition of the above booklet is now available from "Flight" publishing offices. The new work consists of ten chapters and includes many illustrations. Price 3/6 plus 3d. post.

Bombs on Germany

A Three Years Summary : Balance Sheet Reversed

WE publish below the official Air Ministry figures of the tonnage of bombs dropped on Germany by the Royal Air Force, and also the assessed tonnage dropped by the Luftwaffe on Britain. They make interesting reading and account for the German change from bombastic threats against Britain to their present ill-timed and exaggerated whines about the destruction of cultural monuments.

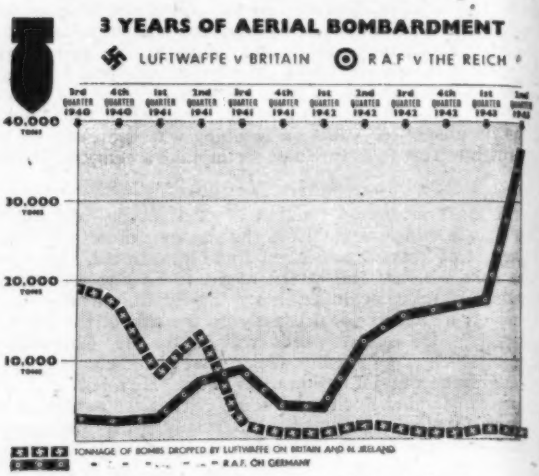
THE balance sheet of the Battle of Britain advertised to the world the supremacy of our fighter aircraft over the *Luftwaffe* when we were on the defensive. The accompanying graph is by way of an interim report which shows the gathering momentum of our bombing of Germany and the supremacy of our bomber aircraft now that we are on the offensive.

Tonnage Table

Here is a comparative table of R.A.F. bomb tonnage dropped by the R.A.F. on Germany and by the *Luftwaffe* on Britain:—

	R.A.F. on Germany Tons	*Luftwaffe* on Gt. Britain Tons
1940, 3rd quarter	.. 2,750	.. 18,900
1940, 4th ,,	.. 2,500	.. 17,000
1941, 1st ,,	.. 2,700	.. 8,000
1941, 2nd ,,	.. 7,200	.. 11,600
1941, 3rd ,,	.. 8,800	.. 1,600
1941, 4th ,,	.. 4,300	.. 600
1942, 1st ,,	.. 3,500	.. 250
1942, 2nd ,,	.. 12,300	.. 1,700
1942, 3rd ,,	.. 15,600	.. 600
1942, 4th ,,	.. 5,600	.. 250
1943, 1st ,,	.. 17,400	.. 800
1943, 2nd ,,	.. 36,700	.. 700

Not one of the present three Axis partners ratified the Hague declaration of 1907 prohibiting bombing from the air, although Great Britain, Austria-Hungary, the United States and Turkey did so. The declaration was, therefore, inoperative when the last war came.



The duel between the R.A.F. and the *Luftwaffe*.

Bombing began, in the primitive state of aviation of those days, with the observer leaning over the side of his open cockpit and dropping small 10lb. bombs by hand! As the war progressed, bombing grew with the use of 40lb., 112lb. and even 520lb. bombs. One German bomb that killed twelve people in London was estimated to be of 300 kg., although the Germans claimed that it was 1,000 kg., i.e., one ton. Twelve aircraft of the Royal Flying Corps in co-operation with the Royal Naval Air Service had to make two journeys to drop 3,000lb. on one target in those days.

In the Present War

The Germans probably thought they had shown the world something when they dropped 18,000 tons on Great Britain in the third quarter of 1940. Yet that was only half the tonnage dropped by Bomber Command in the second quarter of this year, and the total weight of bombs dropped by the *Luftwaffe* on Great Britain up to the end of June is less than half the 120,000 tons dropped by the home-based R.A.F. on Germany. This excludes bombs dropped on occupied territory and bombing by the North African and Middle East air forces and the American bombers, so that the contrast between Axis and Allied bombing is even greater than shown in the graph.

The *cost* of the four Hamburg raids was 88 aircraft, but many men were rescued from the North Sea and many more will be alive as prisoners of war. The *gain* is a first-class military target with all its productive capacity in U-boats, aircraft and munitions of war laid waste.

As there was no aerial bombing before 1914-18, the only comparisons must be made with artillery. The battle of Waterloo was lost and won for an exchange of 37 tons of shells. The South African war absorbed 2,800 tons—a whole war fought on little more than one night's bomb load of to-day! The battle of Jutland took less than 2,000 tons.

RETRIBUTION IN WAITING: A scene in one of the many hundreds of bomb dumps in this country. Apart from all the other complicated organisation necessary to stage a heavy raid on Germany, the production and supply of the explosive is a great feat in itself.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

SUPER-SONIC SPEEDS

Can an A.S.I. Estimate Them ?

SINCE an air speed indicator is a barometric or "pressure" instrument, calibrated (at least basically) in accordance with the "velocity squared" formula, it is difficult to see how super-sonic speeds can be estimated with such a device.

From the point of view of recording air speed, the problems brought about by compression of the air at these velocities must be staggering, yet one hears of aircraft being dived at speeds up to 780 m.p.h.

Surely, the figures mentioned are, to a large extent, arrived at by pure guesswork?

"TOOLMAKER."

DIHEDRAL

Plea for Standardised Terms

IN reference to your paragraph on "dihedral" in *Flight*, August 12, it is suggested that terms in general use in aviation circles be standardised from an international standpoint. This would do much to eliminate friction, confusion and ambiguities in post-war commercial aviation in which international airlines will predominate.

For the word "dihedral" might possibly be substituted the term "V-form" without in any way confusing the popular use of the V sign (V for Victory). Many international designers and constructors of aircraft are already familiar with the expression "V-form," as defining the upward angle of a wing from the horizontal.

W. REGINALD DAINTY
Hon. Capt., R.A.F. (R.N.), Ret.).

BOMBER ARMAMENT

Losses Mostly Due to Night Fighters ?

MAY I intrude upon your columns again and reply to a pair of letters in *Flight* of July 15th? Mr. C. C. Cowen states that production of 0.303in. machine guns and the accessories is in full swing and that to change to larger calibre machine guns would interfere with output. This is surely a very poor argument. If we pursued this policy in regard to aircraft types our Air Force would soon be equipped with second-rate aircraft.

If we chose the 0.5in. machine gun for our revised armament we would meet very few production "snags." The 0.5in. machine gun is already in existence and has proved its worth in action. A fine example of the ease with which an established product can be produced in another country is the Rolls-Royce Merlin aero engine. These are successfully turned out in America with only a handful of British Rolls-Royce technicians present.

The nose armament of the Halifax has been reduced to give better streamline form. Experience showed that nose attacks rarely develop. In the case of the Halifax II series IA the total armament is greater than on earlier versions.

Since my last letter appeared in *Flight*, another variant of the magnificent Mosquito has been announced. This is a version of the Mark II and carries a bomb load of 1,000 lb. in the rear section of the bomb bay in addition to four 20 mm. cannons and four 0.303in. machine guns. This is the first announced type of Mosquito which carries both bombs and armament. Imagine the value of this redoubtable weapon. Long range, high speed, heavy armament, bomb load, sturdy construction, magnificent flying qualities and manœuvrability are all combined to form a war-winning aircraft of the highest quality. Are not low-level attacks by these aircraft as devastating as high-level attacks by the Americans?

In the low-level attack the bombs can be placed on a small target, causing grave dislocation and damage.

This does not mean that I am running down the high-level attacks entirely. For area bombing of important targets with balloon barrages high-level attack is best, but if a small target has to be plastered the low-level bomber will do the trick better. For such attacks the Mosquito and Typhoon are eminently suitable for long and short ranges respectively. The low-level attack is immune from heavy anti-aircraft fire, and one who has seen a fast low-flying aircraft will realise the difficulties with which the ground light A.A. gunner has to contend.

I would how like to comment upon some points made by Mr. V. Redman. He puts forward his arguments very well, but there are one or two flaws.

He says that if Fortresses attempted night raids into the Ruhr they would have to fly singly and that their 0.5in. machine guns would afford no protection against the many German A.A. guns. This ignores the fact that the *Luftwaffe* puts many night fighters into the sky on the nights we make heavy raids. These fighters take advantage of the light armament of our bombers. It is remarkable that our losses are not greater, but they could be still further reduced if our "heavies" had greater armament. I am prepared to warrant that the majority of our night bomber losses are due to night fighters.

It was stated in a London newspaper on July 15th that on the previous day a secret debate on British heavy bomber armament had taken place in the House of Lords. Therefore it seems hopeful that something is being done about this vital question, but I would have felt happier if that debate had been between leading British aircraft armament experts.

A. T. HENSHAW.

ELEMENTARY FLYING TRAINING

Vertical and Horizontal Components

WITH reference to Mr. N. Gilson's letter in your issue of July 29th on climbing and gliding turns as explained in *Elementary Flying Training*, it would appear that the author of that otherwise excellent handbook has not taken account of the direction of the vertical component of the relative airflow.

In any spiral turn an aircraft has a particular vertical velocity and also a rotational velocity. Since the aircraft is rigid this means that each wing tip has the same vertical velocity, but that the outer tip has a higher horizontal velocity than the inner. Hence, the resultant airflow at the inner tip is more sharply inclined to the horizontal than that at the outer tip, as shown in the following diagrams:—

FIG1 GLIDING TURN NOTE B>A

FIG.2. CLIMBING TURN NOTE B>A

The writer of *Elementary Flying Training* has failed to realise that in a climbing turn the vertical component of the relative airflow is *downward* and in a gliding turn *upward*.

In a climbing turn, then, the angle of attack is decreased at both tips, but most at the inner tip, hence the aircraft tends to roll on to the turn and must be held off. In a gliding turn the angle of attack is increased at both tips, again most at the inner tip, hence the aircraft tends to roll off the turn and must be held on.

In each case the fact that the outer tip has a higher resultant velocity means that in any turn, flat or spiral, there is a tendency to roll on to the turn, which increases the above effect in the case of a climbing turn, and partly counteracts it in a gliding turn.

To sum up, we have:

(1) *Gliding turn*—hold *on* gently.
(2) *Climbing turn*—hold *off* hard.
(3) *Flat turn*—hold *off* gently.

Hoping this is a correct explanation.

JAMES R. PALMER.

IN THE STUBBLE : R.A.F. and U.S.A.A.F. aircraft operating from Sicilian cornfields as soon as the harvest is cleared. The bullock cart provides a perfect foil for the 400 m.p.h.-plus Spitfires.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Fleet Air Arm Badges

A FLEET order announces that all officers on the active and retired lists who have at any time qualified as pilots or observers in the Fleet Air Arm should wear the Fleet Air Arm pilot's or observer's badge.

Naval officers who have qualified as pilots or observers in another service or in the Royal Navy Air Service should also wear the appropriate Fleet Air Arm badge.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations :—

Distinguished Flying Cross

F/O. F. A. DUNGEY, R.A.F.V.R., No. 77 Sqn.—This officer has proved himself to be a navigator of outstanding ability who has successfully attacked some of the most heavily defended objectives in Europe, including Genoa and Berlin.

F/O. E. FRANCIS, R.A.F.V.R., No. 138 Sqn.—This officer has flown on a large number of operational sorties. It is largely due to the ability displayed by F/O. Francis that many of these operations have been successful.

F/O. E. S. HAYES, R.A.F.V.R., No. 156 Sqn.—F/O. Hayes came to this squadron with an excellent reputation as an air gunner, which he has fully maintained. He has displayed outstanding qualities of determination and courage while operating over many of the important and highly fortified centres in enemy territory.

F/O. R. E. HEWLETT, R.A.F.V.R., No. 161 Sqn.—This officer has taken part in attacks on Hamburg, Kiel, Bremen and Essen with coolness and courage despite enemy opposition and his gallantry and devotion to duty have always been beyond praise.

F/O. M. S. HOLGATE, R.A.A.F., No. 207 Sqn.—This officer has successfully completed a large number of operational sorties. On one occasion after the target had been attacked, the navigator in this officer's aircraft became very ill, and was unable to continue his duties. F/O. Holgate took over the navigator's duties in addition to his own, and by his assistance enabled his captain to fly the aircraft safely back to base.

F/O. R. E. HOLGATE, R.A.F.V.R., No. 61 Sqn.—As wireless operator/air gunner, this officer has participated in a large number of successful attacks on objectives in enemy territory. Many of these have been against distant targets, such as Berlin and Spezia, and also over heavily defended centres in the Ruhr. Throughout all his sorties he has never had a wireless failure. Even when his aircraft has been damaged by anti-aircraft fire he has remained cool, and made the maximum use of his wireless apparatus.

F/O. R. C. HOWITT, R.A.F.V.R., No. 149 Sqn.—This officer has participated in a number of successful sorties against targets in Germany, including Berlin, Bremen, Stuttgart, the Ruhr and shipbuilding yards at Lubeck. While on the flight to Lubeck the aircraft's compasses became unserviceable, but, undeterred, F/O. Howitt, by superb navigation, guided the bomber safely to the target and back.

F/O. J. A. JOHNSTONE, No. 101 Sqn.—F/O. Johnstone has a very fine record of operational work, achieved over some of the most strongly defended enemy targets. These have included Berlin, Essen, Bremen and Cologne.

F/O. E. E. KITCHEN, R.A.F.V.R., No. 10 Sqn.—Throughout his operational tour this officer has been an outstanding member of a very successful crew. Over such heavily defended objectives as Kiel, Essen and Berlin, F/O. Kitchen, displaying coolness and composure, has secured many valuable photographs.

F/O. D. G. KNIGHT, R.A.F.V.R., No. 101 Sqn.—Throughout his tour of operations this officer has always displayed great keenness and determination in the execution of his duties. Many sorties have been against major targets, such as Berlin, which he has raided four times, and Essen, to which he has made four flights.

F/O. A. S. MACWILLIAM, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—F/O. MacWilliam took part as a rear gunner in two of the "1,000-bomber" raids. Since then he has completed many sorties, including no fewer than five raids on Essen. The vigilant watch kept by this officer has, on more than one occasion, enabled his captain to avoid encounters with enemy fighters.

F/O. I. C. MEIKLE, R.A.F.V.R., No. 43 Sqn.—This officer is employed as an air gunner. He has completed a large number of successful sorties, made more effective by first class crew co-operation, in which he has played an important part. In December, 1942, he was responsible for the destruction of an enemy aircraft while over a target in Germany.

F/O. R. W. NIVEN, R.A.F.V.R., No. 106 Sqn.—F/O. Niven has displayed great courage and navigational ability throughout his operational tour. His first sortie was a successful attack on Berlin, and the high standard of skill he then displayed has been maintained on many later flights.

F/O. W. THOMAS, R.A.F.V.R., No. 115 Sqn.—F/O. Thomas has invariably displayed great courage and devotion to duty in the face of the enemy. He has attacked many important and well-defended enemy targets, such as Turin, Hamburg and Berlin.

F/O. R. N. WILLIAMS, D.F.M., R.A.F.V.R., No. 83 Sqn. (now prisoner of war).—On one occasion this officer participated in a daylight raid on Danzig, where his aircraft was badly damaged. This officer has completed 37 operational sorties, and has at all times displayed great courage and endurance.

P/O. F. C. ALLCROFT, R.C.A.F., No. 61 Sqn.—On his first sortie which was against heavily defended objectives at Essen, the aircraft in which this officer was flying was hit by anti-aircraft fire, but, undaunted by this, he bombed the target and made a safe return on three engines. During a sortie to Dortmund in May, 1943, his aircraft was attacked by enemy fighters on the outward flight. After the attack had been skilfully evaded, one engine in his aircraft failed, but, despite this, he proceeded to the target, which was successfully bombed. On the return journey another engine failed, but by superb skill and determined courage, this pilot made a safe return.

P/O. F. C. ANNAND, R.C.A.F., No. 51 Sqn.—Since P/O. Annand was posted to this unit he has completed numerous anti-submarine patrols and bomb raids. P/O. Annand has participated in attacks on Emden Berlin, Kiel and Frankfurt, and many other heavily defended targets.

P/O. R. N. AYLES, D.F.M., No. 61 Sqn.—Since the award of the D.F.M., this officer has taken part in many operations with much success. Even when his aircraft has been damaged by anti-aircraft fire, he has remained cool and undaunted, and his example has been an inspiration to his crew. During his second tour of duty he has completed three attacks on Berlin and six on Essen, and has also operated against heavily defended targets in the Ruhr and Italy.

P/O. D. W. BATEMAN, R.A.F.V.R., No. 77 Sqn.—This officer has a fine record of operational missions. P/O. Bateman has completed a number of hazardous anti-submarine patrols, and has also assisted in bombing attacks on many dangerous European targets such as Cologne, Genoa, Munich and Wilhelmshaven.

P/O. J. C. BLAIR, R.A.F.V.R., No. 149 Sqn.—This officer has displayed exceptional determination and skill in pressing home his attacks. He has taken part in sorties to Berlin, Mannheim, Turin, and many targets in the Ruhr, always with great enthusiasm and courage.

P/O. A. D. BOUSCHARD, R.C.A.F., No. 83 Sqn.—This officer's sorties have included two attacks on Essen, four on Dusseldorf and two on Duisburg. One night in December, 1942, he was rear gunner of an aircraft detailed to attack Munich. On the outward flight the aircraft was attacked five times by a night fighter, seriously damaged and set on fire. During these attacks P/O. Bouschard remained at his post, and by a well-delivered running commentary assisted his pilot to evade the fighter. Subsequently he helped to put out the fire.

P/O. H. J. BREWER, R.A.F.V.R., No. 61 Sqn.—This officer has completed numerous operational sorties, many of which have involved attacks on

the most heavily defended German and Italian targets, including Berlin, Cologne, Essen, Turin and Milan. He has obtained some excellent photographs.

P/O. J. N BUCKLAND, R.A.F.V.R., No. 101 Sqn.—During his tour of operations with this squadron P/O. Buckland has set and maintained a very high standard of efficiency as a wireless operator. Amongst the targets which his crew has attacked have been such places as Hamburg, Cologne, Berlin and Munich.

P/O. C. N. CAMPBELL, R.A.A.F., No. 467 (R.A.A.F.) Sqn.—As bomb aimer, P/O. Campbell has completed numerous operational sorties against a variety of heavily defended targets in enemy occupied territory. He has obtained some excellent photographs. In April, 1943, this officer was detailed for an attack on an enemy target. While on the outward journey the forward escape hatch of his aircraft came adrift and fell away, leaving P/O. Campbell, as bomb aimer, in a most dangerous position. Although still about two hours away from the target, he would not leave his post, but continued with his duties and released the bombs over the target.

P/O. R. M. CANVIN, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—During his tour of operational duty this officer has completed three raids on Berlin and a number of sorties to the heavily defended areas of the Ruhr and Rhineland.

P/O. R. S. CLINTON, R.C.A.F., No. 425 (R.C.A.F.) Sqn.—This officer has been engaged in many successful sorties over enemy territory against a large variety of targets, including Kiel, Hamburg, Essen and Cologne.

Low Over Essen

P/O. F. B. DASHPER, R.C.A.F., No. 61 Sqn.—This officer has completed a large number of operational sorties, involving attacks on some of the enemy's most heavily defended targets, including Berlin, Bremen, Duisburg, Milan, Turin and Spezia. On one occasion during an attack on Essen he flew low enough to enable his gunners to attack searchlight and anti-aircraft posts.

P/O. T. R. DAVIES, R.A.F.V.R., No. 103 Sqn.—This officer is an experienced navigator of outstanding ability. He has taken part in many operational missions, most of which have been directed against the heavily defended targets in the Ruhr and Western Germany.

P/O. F. EASTON, R.A.F.V.R., No. 10 Sqn.—This officer has taken part in a large number of operational sorties. It is characteristic of his ability and resolution that he has on only two occasions failed to secure photographs of the target area. His aircraft has been damaged several times by anti-aircraft fire, and once, over Duisburg, was attacked by two night fighters.

P/O. R. O. FRENCH, R.N.Z.A.F., No. 75 (N.Z.) Sqn.—On several occasions this officer has secured photographs of the aiming point which have provided valuable information. His missions over enemy territory have included attacks on Berlin, Cologne and Duisburg, all of which have been accomplished with great skill and determination.

P/O. W. C. GORDON, R.C.A.F., No. 101 Sqn.—In August, 1942, this officer was one of a crew whose aircraft was forced down at sea, following an attack by enemy fighters. They were eventually rescued, though P/O. Gordon was injured, after 11 hours in the dinghy. On another occasion, while on a sortie to Essen, this officer's aircraft was badly damaged by night fighters. The rear gunner was killed and another member of the crew wounded.

P/O. J. F. HACKING, R.A.F.V.R., No. 83 Sqn.—This officer, as a navigator, has displayed outstanding efficiency during sorties which have included two raids on Berlin, three on Essen and eight on Italian objectives. This officer, on completion of his tour of operational duty, volunteered to complete further missions.

P/O. B. E. J. HUTT, D.F.M., R.A.F.V.R., No. 138 Sqn.—Since the award of the D.F.M. this officer has completed a number of operational sorties. His cheerfulness, courage and devotion to duty have been a constant source of inspiration to the squadron.

P/O. D. I. JONES, R.A.F.V.R., No. 97 Sqn.—This officer has now completed numerous operational sorties. Displaying outstanding courage and determination, he has participated in attacks on such objectives as Essen, Berlin and Hamburg, where intense opposition was encountered. He has also taken part in raids over distant targets such as Spezia.

P/O. G. D. J. KING, R.A.F.V.R., No. 103 Sqn.—This officer has been employed as captain of aircraft with this squadron since December, 1942. On many occasions he has secured outstanding photographs. P/O. King has taken part in sorties against Spezia, Dortmund, Essen and Berlin.

P/O. K. R. KNAPP, R.C.A.F., No. 428 (R.C.A.F.) Sqn.—On one occasion, while engaged in mine laying, the aircraft in which P/O. Knapp was flying was engaged by anti-aircraft fire and searchlights. The pilot was temporarily blinded and the aircraft struck the water, damaging the port propeller and engine. Displaying great skill and fine airmanship, P/O. Knapp regained control and flew the aircraft back to this country, where a successful landing was made.

P/O. R. A. LIVINGSTON, R.C.A.F., No. 425 (R.C.A.F.) Sqn.—This officer has taken part in a large number of operational missions as wireless operator/air gunner. On one occasion, during a daylight attack on Oldenburg, the aircraft in which he was flying was hit by cannon shells from two enemy fighters and fire broke out behind the navigator's seat. P/O. Livingston promptly put the fire out, thus enabling the aircraft to return safely.

P/O. J. R. MCCORMACK, R.N.Z.A.F., No. 102 Sqn.—A high proportion of the sorties which this officer has completed with success have been

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attacks on heavily defended targets such as Berlin, Essen, Hamburg, and Munich. P/O. McCormack's fine leadership has been largely responsible for the success of his crew, which has never failed to complete a sortie successfully and has frequently secured outstanding photographs.

P/O. D. MACKIE, R.A.F.V.R., No. 156 Sqn.—This officer has taken part in numerous operational sorties since joining this squadron at the end of January, 1943. Many of these have been of a particularly arduous and exacting nature and have taken him to such heavily defended localities as Essen, Berlin and Duisburg.

P/O. H. P. MASON, R.A.A.F., No. 83 Sqn.—Throughout a large number of operational sorties, many of them attacks on heavily defended centres such as Berlin, Essen and Kiel, this officer has displayed the greatest determination to complete his mission. On one occasion, P/O. Mason's aircraft was coned by searchlights over Essen and hotly engaged by enemy anti-aircraft fire. Despite this, he carried on until the target could be accurately sighted before releasing his bombs.

P/O. H. J. MORRISON, R.A.F.V.R., No. 218 Sqn.—In June, 1942, while on a mission to Bremen, his aircraft was attacked by three enemy fighters. P/O. Morrison kept watch for his gunners from the astrodome, and, by his directions, his captain was able to take effective evasive action. On another occasion, while attacking Warnemunde, the aircraft was driven far off its course by intense anti-aircraft fire and only the most skilful wireless work by P/O. Morrison enabled the crew to reach base.

P/O. J. F. MUNRO, No. 97 Sqn.—This officer has displayed a high standard of determination and efficiency during numerous operational missions. Many of these have been completed in the face of intense opposition over such targets as Essen, Berlin, Spezia and Milan.

P/O. H. S. NICHOLSON, R.A.F.V.R., No. 106 Sqn.—P/O. Nicholson has taken part in a large number of operational sorties against targets in Germany, Italy and the Mediterranean battle area. More recently he has participated in bombing raids against such heavily defended targets as Cologne, Essen, Bremen and Duisburg.

Engine Failure Over Berlin

P/O. G. W. OLDHAM, R.A.F.V.R., No. 61 Sqn.—P/O. Oldham has taken part in a large number of operational sorties and, in spite of the strongest opposition, has invariably obtained excellent photographs. In March, 1943, during an attack on Berlin, one of his engines failed before he reached the inner defences of the city. With skill and courage he successfully completed his mission and flew his aircraft safely home.

P/O. S. W. PEGLAR, R.A.F.V.R., No. 103 Sqn.—The majority of the missions in which this officer has participated as bomb aimer have been attacks on targets in Germany such as Berlin, Kiel, Essen and Cologne, over which violent opposition is invariably encountered.

P/O. C. J. PLUMMER, R.A.F.V.R., No. 103 Sqn.—P/O. Plummer has participated in a number of operational missions of which three have been attacks on Berlin and eight on heavily defended centres in the Ruhr. In April, 1943, while returning from a raid on Duisburg, his aircraft was attacked by a night fighter and sustained considerable damage. The attack was prolonged, but despite the severe strain to which he was subjected, P/O. Plummer displayed great fortitude and resourcefulness, giving every assistance to his captain and thus being materially responsible for the safe return of the aircraft.

P/O. D. A. RAWES, R.A.F.V.R., No. 61 Sqn.—This officer has completed numerous operational missions. He took part in the daylight attacks on Le Creusot and in bombing attacks on Berlin, Essen, Cologne, Duisburg and Milan.

P/O. T. W. ROBINSON, R.A.F.V.R., No. 101 Sqn.—P/O. Robinson's sorties have included attacks on Berlin, Nuremberg and Munich, as well as six against Essen. The excellent results achieved by his crew have been largely attributable to the skill, co-operation and coolness displayed by this officer.

P/O. J. F. SAMUEL, R.A.A.F., No. 12 Sqn.—This officer has completed a very creditable tour of operational duty as navigator. He has taken part in sorties to such strongly defended enemy targets as Berlin, Munich, Hamburg and the Ruhr.

P/O. E. A SKILLETER, R.C.A.F., No. 61 Sqn.—During his operational tour this officer has participated in the daylight attacks on Le Creusot and Milan, as well as in attacks on many of the most strongly defended objectives in Germany and Italy.

P/O. R. B. SMITH, R.A.F.V.R., No. 425 (R.C.A.F.) Sqn.—P/O. Smith has completed a large number of successful night sorties over the more heavily defended enemy targets such as Frankfurt, Mannheim, Kiel and Cologne.

P/O. E. E. STOCKER, No. 35 Sqn.—P/O. Stocker is a most capable flight engineer. He has taken part in many sorties against the most important and strongly defended targets in Germany and occupied territory, including raids on Berlin, Hamburg, Milan and Spezia.

Inspiration to Crew

P/O. W. T. TIMPERLEY, R.A.F.V.R., No. 166 Sqn.—P/O. Timperley's courage, efficiency and determination have been tested over very many of the more strongly defended European targets, including Essen, Cologne and Duisburg, and under all circumstances have been an inspiration to his crew.

P/O. J. F. THOMSON, R.N.Z.A.F., No. 158 Sqn.—During a large number of sorties, many of them attacks on well-defended objectives such as Essen, Berlin, Duisburg and Dortmund, this officer has invariably displayed a high order of courage and determination in identifying the target and pressing home his attacks.

P/O. W. S. TREACY, R.A.F.V.R., No. 97 Sqn.—P/O. Treacy has now completed a large number of operational sorties over enemy territory. Over such targets as Essen, Berlin, Cologne and Duisburg where intense opposition is invariably encountered, he has never allowed anything to interfere with his cool and courageous completion of his duties.

P/O. G. A. VINISH, R.C.A.F., No. 10 Sqn.—In March, 1943, while on a sortie to Essen, this officer completed his mission successfully though his tail gunner was seriously wounded and one engine in his aircraft was unserviceable. On another occasion he again bombed Essen effectively although his windscreen had been shattered and fragments blown into his face.

P/O. W. WHITEHOUSE, R.A.F.V.R., No. 103 Sqn.—This officer has completed a distinguished tour of operational duty as air gunner. He has taken part in raids on many distant and dangerous objectives in enemy territory, having attacked Essen, Berlin, Hamburg and Cologne.

P/O. J. A. ZEE, R.C.A.F., No. 7 Sqn.—On several occasions this officer has demonstrated his possession of cool courage while pressing home his attacks on such heavily defended targets as Essen, Nuremberg, Berlin and Frankfurt.

W/O. M. W. CARROLL, R.A.A.F., No. 467 (R.A.A.F.) Sqn.—As navigator this officer has completed a large number of operational sorties against heavily defended enemy targets without a single failure. He has operated effectively against such objectives as Cologne, Bremen, Essen and Berlin, and also took part in a raid on Spezia.

W/O. G. DENWOOD, No. 103 Sqn.—W/O. Denwood, now on his second operational tour of duty, has completed many operational sorties. An outstanding member of a gallant crew, this captain of aircraft's exemplary conduct has on all occasions been most praiseworthy.

W/O. J. W. LUKE, R.A.F.V.R., No. 12 Sqn.—W/O. Luke has completed two successful tours of operational duty, during which he has attacked many of the enemy's most strongly defended targets, including Berlin, Essen, Stuttgart and Milan.

W/O. N. R. ROSS, No. 103 Sqn.—W/O. Ross,

AT THE PALACE: (Left to right) Group Capt. P. C. Pickard, D.S.O. and Bars, D.F.C., Sqn. Ldr. W. W. Blessing, D.S.O., D.F.C. (R.A.A.F.), and Group Capt. G. L. Cheshire, D.S.O. and Bar, D.F.C., at an investiture at Buckingham Palace.

now on his second tour of operational duty, has taken part in a large number of operational sorties. An excellent captain of aircraft, in the face of heavy odds, he has shown courage and determination of a high order, and has secured some excellent photographs.

Distinguished Flying Medal

Flt. Sgt. R. W. COPSEY, No. 218 Sqn.—This airman has participated in attacks against many of the most heavily defended targets in Germany. On one occasion, when flying on a low level night attack against a target in Germany, he was wounded in the leg by anti-aircraft fire. Although in considerable pain Flt. Sgt. Copsey insisted on making a second run in order to drop his bombs on the target.

Flt. Sgt. C. J. DABORN, No. 77 Sqn.—Throughout his operational tour in Coastal and Bomber Commands, Flt. Sgt. Daborn, in the capacity of wireless operator, has shown a high standard of efficiency. His sorties include attacks on some of the most heavily defended targets in Germany, including Kiel, Duisburg and Berlin.

Flt. Sgt. J. DUNSEATH, No. 77 Sqn.—Flt. Sgt. Dunseath has completed a large number of successful sorties. An exceptionally skilful air gunner, who is thoroughly painstaking in preparation, his courage and tenacity in attack have been worthy of high praise.

Flt. Sgt. E. H. EAST, R.A.A.F., No. 101 Sqn. —Flt. Sgt. East has completed a large number of operational sorties. On one occasion he was detailed for a night attack on Wilhelmshaven. When over the target, his wireless receiver went dead, but this airman effected a temporary repair by using odd wire which enabled weak signals to be received and, with the aid of these, a safe return to base was made.

Flt. Sgt. J. M. FRYER, No. 35 Sqn.—An air gunner of the highest standard, Flt. Sgt. Fryer has completed many operational sorties. He has participated in attacks on most of the major targets in Germany and in long-distance operations against towns in Italy.

Flt. Sgt. W. H. GOODRIDGE, No. 419 (R.C.A.F.) Sqn.—Flt. Sgt. Goodridge has taken part in a large number of operational sorties against targets in Europe and the Middle East. His operations include attacks against Berlin, Hamburg, Essen, Kiel, Stettin and Munich as well as Naples, Tripoli and Benghazi.

Flt. Sgt. G. R. GOODWIN, No. 77 Sqn.—As captain of aircraft Flt. Sgt. Goodwin has completed a meritorious tour of operations throughout which he has displayed the utmost vigour, courage and determination.

Flt. Sgt. T. H. A. HILL, No. 51 Sqn.—This airman has taken part in attacks against some of the enemy's most heavily defended targets, such as Essen, Duisburg, Cologne and Berlin. An exceptionally good air gunner he has set an example of coolness and courage.

Flt. Sgt. V. HODGKINSON, No. 138 Sqn.—Flt. Sgt. Hodgkinson has completed a large number of operational sorties. On several occasions has been instrumental in the safe return of his aircraft to base.

Flt. Sgt. T. D. HODGSON, No. 179 Sqn.—Flt. Sgt. Hodgson has completed many operational sorties and has flown many hours on anti-submarine operations. In November, 1942, this airman was wounded during an attack on an enemy U-boat. Nevertheless, he persisted with great determination in pressing home the attack in the face of intense enemy opposition.

Flt. Sgt. A. D. KEMP, R.A.A.F., No. 103 Sqn. —Flt. Sgt. Kemp has taken part in many successful operational sorties. A very fine captain of aircraft he has consistently shown a high degree of courage, initiative and determination. He has on several occasions secured excellent photographs.

Flt. Sgt. J. F. KEMP, No. 50 Sqn.—Always ready and keen to fly on operations, Flt. Sgt. Kemp, in the capacity of air gunner, has taken part in a large number of operational sorties. Many of his attacks have been against Germany's most heavily defended targets, and he has also participated in sorties against Italian targets.

Flt. Sgt. A. KENNEDY, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Flt. Sgt. Kennedy has participated in a large number of operational sorties. He has taken part in attacks on most of the heavily defended objectives in Germany, including four raids on Berlin.

Flt. Sgt. (now P/O.) R. D. MACKAY, No. 149 Sqn.—This airman has taken part in many operational sorties. On one occasion he participated in a mining operation to the Baltic, in very adverse weather, and his excellent navigation was largely instrumental in the successful completion of the mission.

Flt. Sgt. L. P. MARNEWECK, No. 166 Sqn.—Flt. Sgt. Marneweck has completed numerous operational sorties, throughout which his cheerful confidence has inspired a high standard of morale in his crew. He has participated in many mine-laying operations.

Flt. Sgt. S. A. MASLIN, No. 77 Sqn.—Flt. Sgt. Maslin has participated in a large number of operational sorties, and has at all times shown a complete disregard for his personal safety when attacking some of the most heavily defended German targets.

Flt. Sgt. T. MCKENNA, No. 44 Sqn.—Flt. Sgt. McKenna has completed many operational sorties, in the course of which his efficiency and team spirit have been of a very high standard. He has participated in many attacks on important targets in Italy.

Flt. Sgt. W. McC. MITCHELL, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—As a wireless operator/air gunner this airman has proved to be a most conscientious and efficient member of his crew. He has taken part in many operational sorties over enemy territory.

Flt. Sgt. B. A. NICHOLLS, No. 428 (R.C.A.F.) Sqn.—Flt. Sgt. Nicholls has taken part in operational sorties against practically all the enemy's most heavily defended targets in Germany and France. He has also participated in two "1,000 bomber" raids.

Flt. Sgt. N. T. R. POULTON, R.A.A.F., No. 12 Sqn.—This airman has taken part in a large number of operational sorties, including attacks on such heavily defended targets as Berlin, Essen, Hamburg and Wilhelmshaven, where heavy anti-aircraft fire and searchlight opposition were encountered.

Flt. Sgt. H. C. PRETTY, No. 419 (R.C.A.F.) Sqn.—Flt. Sgt. Pretty has completed a large number of operational sorties. He has taken part in attacks against such major targets as Berlin, Hamburg, Essen, Turin, Bremen and Cologne.

Flt. Sgt. E. C. PRYOR, A.A.F., No. 77 Sqn.—During the course of a large number of operational sorties Flt. Sgt. Pryor has consistently displayed courage and devotion to duty of a high order, setting an admirable example to all with whom he came in contact.

Flt. Sgt. B. T. SCAMMELL, No. 10 Sqn.—On several occasions this airman has displayed remarkable efficiency in repairing intercommunication failures in the minimum of time, and he has twice had his set almost to pieces and together again and in working order in less than an hour. Although his aircraft has several times been damaged by anti-aircraft fire, being twice attacked by enemy night fighters, and has once force-landed, this airman has never lost his enthusiasm and keenness to participate in operations.

Flt. Sgt. J. A. SNEDDON, R.C.A.F., No. 115 Sqn. —Flt. Sgt. Sneddon has completed numerous operational sorties, including some against such heavily defended targets as Frankfurt, Duisburg, Dusseldorf, Essen, Berlin, Kiel and Turin.

Flt. Sgt. F. H. THOMPSON, R.N.Z.A.F., No. 218 Sqn.—Flt. Sgt. Thompson, in the capacity of rear gunner, has taken part in many operational sorties. On one occasion, when returning from a mining operation, he shot out the lights of a searchlight battery. On other occasions this airman has made successful machine-gun attacks on enemy trains and an airfield, where fires were started.

Flt. Sgt. J. A. TURNBULL, R.A.A.F., No. 269 Sqn.—As pilot and captain of a crew which has delivered telling attacks on U-boats, this officer has displayed exceptional keenness and skill. In May, 1943, he sighted a surfacing U-boat. With great skill, he made use of cloud cover to achieve a surprise attack and damaged the submarine.

Flt. Sgt. (now P/O.) D. D. M. WILKINSON, R.N.Z.A.F., No. 161 Sqn.—Flt. Sgt. Wilkinson has taken part in many operational sorties. He has trained his crew to a high standard of efficiency and, by his personal courage and determination to complete his missions successfully, has set a splendid example.

Flt. Sgt. H. J. A. WRIGHT, R.A.A.F., No. 156 Sqn.—This airman has taken part in a large number of operational sorties against targets in Germany, Italy and enemy-occupied territory, in the course of which he has displayed ability as a navigator.

Sgt. F. N. ALEXANDER, No. 97 Sqn.—Sgt. Alexander as navigator has participated in many operational sorties. He has made attacks on some of the enemy's most heavily defended targets in the Ruhr, Berlin, Spezia, Milan and Kiel.

First-class Air Bomber

Sgt. S. D. BALDOCK, No. 10 Sqn.—A first-class air bomber, Sgt. Baldock has taken part in a large number of operational sorties, and it is largely due to his skill and determination that some excellent photographs of the target area have been obtained. Although his aircraft has several times been damaged by anti-aircraft fire and twice attacked by enemy night fighters, this airman has continued to display enthusiasm, cheerfulness and morale of the highest order.

Sgt. A. C. BALL, No. 467 (R.A.A.F.) Sqn.—The successful operational sorties completed by this airman include ten missions to the Ruhr and three to Berlin. Others have been attacks on such places as Spezia and Stettin, where intense opposition has been encountered.

Sgt. W. BENNETT, No. 106 Sqn.—Sgt. Bennett's first two operational sorties were against Berlin, and the high standard of navigation achieved has been maintained throughout his tour. He has now taken part in many operational flights, including operations against Essen, Duisburg, Stettin, and the majority of the enemy's most heavily defended targets.

Sgt. F. J. BILLETT, No. 77 Sqn.—Throughout a very comprehensive tour with Bomber and Coastal Commands, which has included attacks against targets in Norway and Italy, Flt. Sgt. Billett has proved to be most efficient and completely devoted to his allotted task.

Sgt. A. M. BLACK, No. 10 Sqn.—Sgt. Black has taken part in numerous operational sorties. On several occasions the aircraft in which Sgt. Black was flying had been riddled by anti-aircraft fire and twice been heavily damaged, whilst over Essen, nevertheless he has continued to display an unshakeable morale and enthusiasm to participate in operational flying.

Sgt. R. J. BOOTH, R.C.A.F., No. 166 Sqn.—Throughout his many operational sorties, Sgt. Booth has shown commendable courage and devotion to duty. This was particularly exemplified on the occasion of a recent raid on Mannheim during which, despite intense opposition, he displayed outstanding fortitude and skill.

Sgt. K. BROWN, No. 97 Sqn.—This airman has taken part in many operational sorties, some of which have been against such heavily defended targets as Essen, Cologne, Berlin and Spezia.

Sgt. F. W. BROWNE, No. 158 Sqn.—Sgt. Browne has taken part in numerous operational sorties, including attacks on some of the enemy's most heavily defended targets, such as Berlin, Duisburg, Hamburg, Cologne, Nuremburg, Essen, Kiel and Dortmund.

Flt. Sgt. W. HALE, No. 58 Sqn.—Flt. Sgt. Hale has been employed as a navigator for the past 18 months. Recently, this airman has made three attacks on U-boats. On the second occasion he set a most outstanding example of accuracy and knowledge of U-boat tactics. On the third occasion, the enemy vessel was most probably destroyed.

Sgt. W. D. BURCHETT, No. 49 Sqn.—Sgt. Burchett has taken part in a large number of operational sorties, including the daylight raids on Le Creusot and Milan. On one occasion, when returning from Nuremburg, Sgt. Burchett's aircraft was heavily attacked by anti-aircraft fire, and the forward escape hatch became dislodged. He lost most of his maps and equipment, and only saved himself by clinging to the bomb sight mounting brackets. Another time his aircraft was struck on the nose by an incendiary bomb. Sgt. Burchett's intercommunication wires were cut and much of his equipment damaged; nevertheless, he continued to assist the navigator by passing back written messages.

Sgt. (now P/O.) N. E. BURTON, No. 106 Sqn.—This airman has participated in most of the

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TEA UP, CHAPS: The N.A.A.F.I. tea van is an ever-welcome sight at the dispersal points. In the background is a Halifax II with the nose which replaced the turreted version until the present transparent type with gimbal-mounted K gun was fitted.

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important raids undertaken by his squadron recently. These have included attacks on Berlin, Nuremburg and naval bases in Germany and Italy. He also operated effectively in attacks on Duisburg and Essen.

Sgt. D. A. CARTWRIGHT, No. 156 Sqn.—Sgt. Cartwright has taken part in a large number of operational sorties against targets in Germany, Italy and occupied territory. A most capable flight engineer, he has displayed exceptional ability.

Sgt. A. J. CROUCH, No. 10 Sqn.—Despite the fact that his aircraft was on one occasion attacked simultaneously by three enemy night fighters, and on three other occasions has been heavily damaged by anti-aircraft fire when over the target, Sgt. Crouch has continued to display an admirable and unflagging enthusiasm for operations.

Sgt. K. K. DAVIDSON, No. 106 Sqn.—A navigator of skill and determination, this airman has taken part in many bombing raids. Sgt. Davidson has navigated his aircraft unerringly to targets in North West Germany, the Ruhr Valley and Italy, undeterred by the heaviest enemy opposition.

Roll of Honour

Casualty Communiqué No. 268.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 101 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. J. Dixon; P/O. E. C. E. Miles; Sgt. D. Wilkie.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. E. A. Berrett; P/O. P. W. Carr; Sgt. E. N. Galloway; P/O. F. E. Gardiner; Sgt. S. Glover; Sgt. O. V. Owen; Sgt. J. J. Parish; Flt. Sgt. W. P. Ryan; Flt. Sgt. S. M. Selway; Sgt. H. R. Skinner; Flt. Sgt. R. G. Stolz-Page; Sgt. P. G. H. Strudwick; Sgt. J. D. Whitehead.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. R. M. Cumming; Sgt. H. Dyke; Sgt. L. Fitzsimmons; Act. Sqn. Ldr. S. H. Fox, D.F.M.; P/O. A. L. Gaskin; Flt. Sgt. W. N. Geddie; Sgt. A. M. Hamilton; Sgt. P. C. Heath; Flt. Sgt. A. H. Jennings; Sgt. G. R. Lewis; Flt. Sgt. N. A. Mercer; Sgt. B. J. Miller; Flt. Sgt. A. Moffat; Sgt. J. R. Runnicles; P/O. H. Shaw; Sgt. P. MacD. Spence; Sgt. J. D. D. Swinnard; Sgt. J. W. Todd; Sgt. A. W. Vivian; P/O. R. Wallace; Sgt. S. G. White; Sgt. T. T. Wilkinson; Sgt. S. A. Witchell; Sgt. H. F. Wood.

WOUNDED OR INJURED IN ACTION.—Sgt. B. N. Buckley; Sgt. G. V. Collis; F/O. L. A. Komaroff.

MISSING, BELIEVED KILLED IN ACTION.—F/O. R. E. C. Allen; Sgt. A. R. Cardoo; F/O. R. W. H. Carter; Sgt. J. J. Chandler; Sgt. W. F. C. Clague; Sgt. E. S. Coster; Sgt. P. W. Findlay; Sgt. W. George; Sgt. D. B. Gordon; Sgt. F. Hay; Sgt. J. Heywood; Sgt. C. W. Hughes; P/O. R. W. J. Letters; Sgt. R. Raven; Sgt. T. P. Russell; Sgt. P. Smith; P/O. C. Strand; Sgt. C. K. Surgey; Sgt. F. A. Wells.

MISSING.—Sgt. R. M. Anderson; Sgt. C. P. Baker; Flt. Sgt. F. A. Bandy; P/O. R. E. Barckley; Sgt. T. E. Beaver; Sgt. F. Betteridge; Sgt. W. J. Blundell; Sgt. W. Bramwell; F/O. E. K. Cam; Sgt. E. G. Collman; Act. Flt. Lt. D. A. Connell; Sgt. W. V. Garfield; Sgt. A. V. Harper; Sgt. J. B. Harrison; P/O. W. R. Hendon; Sgt. R. L. Hoddle; Sgt. G. Humphreys; Sgt. D. E. D. Kimpton; Sgt. G. A. King; Sgt. J. F. Langley; Sgt. J. A. Lewis; Sgt. H. R. S. Lloyd; Sgt. S. C. Luke; Sgt. D. McColl; Sgt. J. Maitland; Sgt. A. W. Meech; Sgt. R. S. Metcalfe; Sgt. D. R. Munday; P/O. C. A. Nicholls; Flt. Sgt. W. A. Owens; Act. Wing Cdr. A. W. Pennington-Legh; Sgt. G. G. Powis; Sgt. E. Prescott; Sgt. C. A. Richardson; Sgt. H. Robinson; Sgt. J. A. J. Roff; Sgt. A. A. Ross; Sgt. P. H. Sheerman; Sgt. F. C. Sherratt; P/O. F. R. Simon; Sgt. D. C. Smith; Sgt. J. A. Stewart; Sgt. R. Y. Stoddart; Sgt. L. Tucker; Sgt. R. A. Ward; Sgt. P. C. Willars; Sgt. W. Young.

KILLED ON ACTIVE SERVICE.—F/O. E. E. Adlard; P/O. J. H. Briggs; Sgt. J. Brooke; Sgt. J. R. J. Clark; Act. Wing Cdr. J. R. Cridland; A/C.2 W. R. S. Davies; Sgt. G. E. Elkins; P/O. J. Fallon; Sgt. D. E. Faulkner; Act. Flt. Lt. D. W. Foster; Sgt. K. G. Gambell; P/O. G. H. Gould; Sgt. K. G. Griffiths, L.A/C. R. Harwood; Sgt. K. C. Huard; W/O. D. J. Innes-Smith; Wing Cdr. J. S. Kendrick; F/O. J. A. B. Kennedy; P/O. A. F. Lavery; Sgt. E. Lynch; Cpl. J. A. McMahon; Sgt. D. A. Marriott; Sgt. L. C. Medhurst; P/O. P. Millington; Sgt. E. Morgan; Sgt. R. S. Philips; F/O. A. T. L. Rossignol; L.A/C. J. A. H. L. Scotchmoor; Sgt. E. Stevens; Flt. Sgt. W. J. Symons; L.A/C. W. Tunney; F/O. R. C. Wood.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. W. Hewitt; Act. Flt. Lt. R. Neale; Sgt. A. Paterson; Flt. Sgt. M. J. Steer; Sgt. H. B. Trethewey.

TIME IS LIFE : Army casualties on stretchers being loaded into a Douglas C 47 air ambulance on a forward airfield in Sicily.

DIED ON ACTIVE SERVICE.—L.A/C. A. W. Clear; L.A/C. H. R. Fry; L.A/C. F. K. Green; Act. Cpl. B. A. Jenkyn; Cpl. S. E. Kingham; Flt. Sgt. J. U. Lomas; Sgt. W. McFall; A/C.1 J. McKay; Cpl. H. Martin; A/C.2 R. W. Murray; A/C.2 R. W. Pye; F/O. L. Rees; P/O. F. Rogers; Cpl. R. K. W. Rosenberg; Act. Wing Cdr. G. L. M. Schrader.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. R. G. Reynolds.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. P. Dobson; Sgt. W. D. Pierce.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. G. M. Biggin; Sgt. R. V. Chinnery; F/O. J. E. Coates; F/O. R. E. Guthrie; Sgt. G. C. Keats; Flt. Sgt. G. Littlejohn; Sgt. J. O. O'Brien; Sgt. J. E. Ramsey; Sgt. A. G. Welch.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. R. M. Goode; Flt. Sgt. H. A. Miller; Sgt. F. A. Morath; F/O. K. MacD. Simpson.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. T. Taylor.

MISSING.—Sgt. D. F. Bavin; Sgt. H. E. Bull; P/O. B. Burnley; Act. Flt. Lt. R. J. Ingram; P/O. R. C. Lowther; W/O. V. P. Ratcliffe.

KILLED ON ACTIVE SERVICE.—Sgt. K. W. Deacon; Flt. Sgt. G. E. Garrett; Sgt. J. F. C. McPherson; F/O. H. V. C. Sheppard.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. D. J. Clarke.

DIED ON ACTIVE SERVICE.—L.A/C. P. Murdoch.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. H. Jackson; Sgt. N. R. Mitchell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. F. E. Anderson; P/O. L. D. Bowman; Sgt. W. E. Brown; Sgt. H. Bryden; F/O. G. Carlet; Sgt. C. E. Carroll; P/O. E. G. Cavaghan; Flt. Sgt. L. G. Chaston; Sgt. L. M. Cowan; P/O. R. J. Dell; Flt. Sgt. H. W. Dreyer; P/O. J. G. Durkin; P/O. W. D. Frost; Flt. Sgt. C. C. Harris; Sgt. D. B. Henshaw; Flt. Sgt. H. R. Hibbard; Sgt. W. E. W. Holmes; Flt. Sgt. F. Janiszewski; P/O. E. E. E. Johnstone; Flt. Sgt. W. J. Kaufman; P/O. A. Luck; Sgt. A. G. Lynds; Flt. Sgt. A. E. McCoy; Sgt. J. J. Matthews; Sgt. D. A. Millard; Flt. Sgt. A. A. Miller; Flt. Sgt. E. F. Monroe; P/O. W. S. Robb; Flt. Sgt. R. R. Stewart; Flt. Sgt. A. D. Pattinson; Sgt. N. McI. Rattray; Flt. Sgt. G. S. Swansburg; Sgt. W. G. Webb; Flt. Sgt. P. O. Webster; Flt. Sgt. R. W. Whitley; P/O. J. A. Wright.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. S. J. Marugg; F/O. T. M. Pethick; F/O. D. G. Sturrock.

MISSING.—Flt. Sgt. W. S. Sanglin; Sgt E. L. Armstrong; Sgt. R. G. Bailey; L.A/C. T. R. Brookes; F/O. R. W. Clarke; Flt. Sgt. H. G. Collins; Flt. Sgt. H. L. Davis; P/O. D. T. Dorward; P/O. R. G. Fowlie; Act. Flt. Lt. W. H. Gordon; Flt. Sgt. G. E. Greenwood; Sgt. P. S. Grindley; Flt. Sgt. J. C. Harrison; P/O. R. S. Hollowell; F/O. P. G. Holt; F/O. G. H. Hubbell; Sgt. P. S. Johnson; P/O. W. R. King; Sgt. I. S. Levitt; Cpl. J. F. MacKenzie; Sgt. H. MacMillan; Flt. Sgt. A. C. McNabb; Sgt. J. A. G. Marshall; Sgt. E. H. Neilson; W/O. N. W. Peat; Sgt. T. W. Peets; P/O. H. D. Pepper; Sgt. J. A. Pirie; F/O. B. A. Richmond; Sgt. F. L. Shellnutt; Sgt. D. J. Shtitz; Sgt. A. T. Sodero.

KILLED ON ACTIVE SERVICE.—F/O. D. T. Alexander; P/O. J. S. Banks, D.F.M.; Sgt. L. A. Boire; Sgt. H. G. Hagen; P/O. A. T. Hinton; Sgt. D. H. Kelly; P/O. W. G. Mackie; P/O. L. C. Mollet; Sgt. J. C. Nabors; Flt. Sgt. D. Y. Turnbull; Flt. Sgt. J. M. Whittaker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. B. Derrick; Flt. Sgt. A. C. Kelly; Sgt. W. Kravac.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. J. Lowrie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. R. Brailey; P/O. S. G. Brannigan; Flt. Sgt. N. A. Bryson; Sgt. W. H. Plower; Sgt. N. M. Langlands; Flt. Sgt. T. G. B. Patterson; Flt. Sgt. S. D. Ross; F/O. P. H. Ryan; P/O. P. C. Spittal; Flt. Sgt. R. F. Stone.

MISSING, BELIEVED KILLED IN ACTION.—P/O. R. F. Bennett; Flt. Sgt. J. H. R. Carey; F/O. K. T. Estcourt; Flt. Sgt. N. A. MacLeod; F/O. H. Tong; F/O. R. B. Vernazoni.

MISSING.—Sgt. O. A Innes; W/O. S. L. Kavanagh; Sgt. R. F. Norman; F/O. C. H. Riddle.

KILLED ON ACTIVE SERVICE.—F/O. K. R. Holmes; P/O. J. B. Taylor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. D. J. McKenzie.

South African Air Force

KILLED ON ACTIVE SERVICE.—Lt. R. J. Evans; R. Felton; Lt. L. Van Der Vyver.

Casualty Communique No. 269

Of the names in this list 91 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. S. A. Collins; F/O. A. D. Gardner; Sgt. G. Gordon; Sgt. G. Haley; W/O. J. M. Hansen Sgt. S. J. Hoare; Flt. Lt. W. E. Tym; Sgt. G. E. S. Wren.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. E. T. Briggs; Sgt. S. Brownhill; Sgt. W. C. Budd; P/O. A. H. Childs; Sgt. F. J. Eden; Sgt. J. H. Evans; Sgt. H. Flavell; Sgt. P. A. J. Grant; Sgt. E. Hilton; Sgt. D. C. Langford; Flt. Lt. M. B. Mallet; Sgt. A. Nicholas; Sgt. A. F. Smith; Sgt. C. Smith; Sgt. V. F. Vinnicombe; Sgt. S. C. Wedgwood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. W. G. Barrett; P/O. E. Beale; Sgt. R. H. G. Bowkett; Act. Flt. Lt. J. Bryan; Sgt. H. Buchan; Flt. Lt. G. L. Clack; Sgt. E. C. Cohen; Sgt. A. G. Cook; Sgt. T. A. Grey; Sgt. E. N. Grimwood; W/O. W. Harrison; F/O. W. C. Hillier; Sgt. J. G. A. Hoare; F/O. R. C. Hodgson; Sgt. D. L. Howe; Sgt. B. Kaye; Sgt. T. A. Keech; Sgt. R. Kerry; Sgt. J. McGauchie; Sgt. J. L. MacLachlan; Sgt. J. J. Mathieson; Sgt. G. G. Millard; Sgt. N. Podmore; Sgt. A. Potts; Flt. Sgt. J. G. Richardson; Sgt. E. H. Searles; Sgt. J. A. Sharpe; P/O. K. P. Symes; Sgt. E. Webster; P/O. K. J. Williams; Sgt. H. Young.

WOUNDED OR INJURED IN ACTION.—Sgt. J. Dryne; Sgt. W. A. Stivey; P/O. S. L. Walters.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. R. J. Jameson.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. R. Coulsey; Sgt. N. D. Ensor; F/O. H. Forshaw; Sgt. A. Glover; P/O. W. J. Harding-Haydon; Sgt. V. Horsley; P/O. K. McCulloch; Sgt. N. C. Richards; Sgt. P. J. Ruane; Sgt. E.

SERVICE AVIATION

Russell; Act. Sqn. Ldr. D. L. Small; F/O. N. C. Taylor; Sgt. L. Timms; Sgt. R. Tofts; Sgt. P. A. Toms; Sgt. A. R. Veitch; Sgt. R. Watkinson; Sgt. R. E. S. Weddell; F/O. A. E. Whittaker.

MISSING.—Sgt. J. H. Armstrong; Sgt. H. I. Ashdown; Flt. Sgt. T. W. Atkins-Tallentine; Flt. Sgt. L. J. Austin; Sgt. A. G. Ballantyne; Sgt. R. A. Beaton; Sgt. C. S. Bell; Sgt. R. E. Bell; Sgt. H. J. T. Bennet; Sgt. R. J. Boardman; Sgt. L. Borthwick; Sgt. K. L. Bowerman; Sgt. A. Boydell; Sgt. R. C. H. Brand; Sgt. D. W. Brough; Flt. Lt. A. McK. Brown; Sgt. C. J. Buckel; Sgt. E. Burton; Flt. Sgt. W. J. Chapple; Sgt. J. Cliffe; Sgt. W. Cram; F/O. A. V. Crawford; Sgt. J. V. Dartnall; Sgt. A. E. Davey; Sgt. A. V. Dorman; Sgt. W. A. Drew; Sgt. E. W. Durrant; Sgt. W. Duxbury; Sgt. P. A. R. Eason; F/O. J. L. Edwards; P/O. J. Evans; Sgt. R. G. Foot; Sgt. R. E. Gill; Flt. Lt. F. W. Gilmore; Sgt. J. Greenway; Act. Sqn. Ldr. G. B. Haywood; Sgt. J. Hindley; Sgt. F. G. Hooper; Sgt. E. F. Jones; F/O. R. Kirby; P/O. R. G. Kirby; Sgt. P. Koek; Sgt. G. G. Lane; Sgt. C. W. Larkin; F/O. T. J. J. Lee; P/O. H. F. Lewis; Flt. Sgt. J. Liddle; Sgt. W. L. Lumsden; Sgt. J. B. McHendry; Sgt. E. C. McMillan; Sgt. C. W. H. Makin; Sgt. R. A. Martin; Sgt. G. A. Mason; Sgt. T. Maxwell; Sgt. R. W. Meadows; Sgt. E. H. Morley; P/O. J. E. Norris; Sgt. B. Nunn; Flt. Sgt. J. H. Nuttal; F/O. H. D. Oates; Sgt. D. G. M. Ofield; P/O. R. H. Parr; F/O. D. E. Paul; Sgt. J. E. Plummer; Sgt. H. E. Rawlings; Sgt. W. G. Reed; Sgt. R. W. Rivers; F/O. S. Q. Robinson; Sgt. D. Ruocco; Sgt. J. H. Saville; P/O. W. E. Sawdy; P/O. E. G. Seall; Sgt. E. S. Smith; Sgt. V. G. L. Smith; Sgt. R. L. Sowerby; Sgt. J. C. W. Stevens; F/O. D. L. Stevenson; Sgt. F. J. Stoker; Sgt. R. M. Stone; Sgt. G. Swan; Sgt. V. J. Tarr; F/O. J. E. Thomas; Sgt. S. A. Thornton; Sgt. L. Toal; Sgt. A. W. Waite; Sgt. R. E. P. West; Sgt. K. Wilcock; Sgt. A. G. Wright; Sgt. B. W. Wyatt.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—P/O. D. G. Leven.

KILLED ON ACTIVE SERVICE.—Sgt. J. S. Boyd; Sgt. G. R. Dawson; Sgt. N. E. Ellacott; Sgt. A. J. Greatbatch; Sgt. B. Meadowcroft; Flt. Sgt. T. O'Leary; P/O. M. P. Salisbury-Rowswell; Flt. Sgt. F. J. A. Steel; P/O. R. Tomlinson; Cpl. E. G. Wood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sqn. Ldr. M. Ballard; Sgt. G. F. Lyman-Dixon; Sqn. Ldr. G. Robinson; Sqn. Ldr. W. J. Stewart.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 R. G. A. Bucksey; Sgt. L. A. Butler.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. A. E. Gray, D.F.M.; L.A/C. H. Walsh.

DIED ON ACTIVE SERVICE.—A/C.1 J. O. F. Ferrett; A/C.2 R. Hamilton; Sgt. A. Quillan; L.A/C. A. Ross; L.A/C. T. Thomason; L.A/C. R. Upton.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. F. E. Schultz.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. A. H. Beesley; F/O. S. F. Belbin; Sgt. J. G. Crockett; Sgt. E. L. Davies; Sgt. R. G. McCauley; F/O. C. H. D. Moseley; F/O. H. J. Thomson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. A. C. Campbell; Sgt. M. D. Hart; F/O. H. L. Mazengarb; F/O. D. de M. Partridge; F/O. E. H. Renfree; Flt. Sgt. M. J. Standley; Sgt. C. H. Thompson; Sgt. R. T. A. Wallis; Sgt. J. W. E. Wilson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. G. R. Cope; F/O. R. L. Gordon; P/O. M. T. Cotton.

MISSING.—Sgt. T. A. Belot; Flt. Sgt. E. E. Burton; Sgt. P. L. Cashion; Sgt. D. H. Crouch; Flt. Sgt. D. Douds; Sgt. D. S. Finlason; Sgt. G. H. Gray; Sgt. R. McL. Grieve; Flt. Sgt. R. A. Hatfield; Flt. Sgt. E. G. Holden; Sgt. J. S. Lee; Sgt. L. H. MacDonald; Sgt. V. C. McQuade; Flt. Sgt. S. F. Miller; Flt. Sgt. W. D. Weir.

KILLED ON ACTIVE SERVICE.—P/O. J. Ahearn; Flt. Sgt. R. Ambler.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. F. T. Dingwall; Sgt. G. D. G. Morrison; Sgt. W. A. B. Stokes.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. G. Clements; Sgt. F. W. Gennette; Sgt. W. Jackson; Sgt. J. J. Labossiere; Sgt. J. McCartney; Sgt. C. A. Sherman; Sgt. J. R. F. Soutar.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. H. J. Byrd; Flt. Sgt. D. J. Calderwood; Flt. Lt. J. S. Coulter; Sgt. J. P. Doyle; P/O. J. K. Ferguson; Sgt. W. M. Garside; Sgt. W. G. Gittings; Flt. Sgt. L. T. Goodfellow; F/O. W. A. McMurchy; P/O. T. E. Oliver; Sgt. D. R. Smith; Sgt. J. Tait; F/O. W. H. Thomas; Sgt. H. R. Watson; Sgt. E. B. Willoughby.

WOUNDED OR INJURED IN ACTION.—Sgt. J. D. E. Lachapelle.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Lt. L. E. Blight.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. L. Chatfield; Sgt. A. Cook; Sgt. E. B. Stevenson; Sgt. R. H. Van-Camp.

MISSING.—P/O. J. R. Bickerton; Sgt. R. W. Billing; Sgt. D. G. Bird; P/O. D. S. Brown; P/O. A. B. Clegg; F/O. G. K. Crummy; Sgt. L. E. Daw; P/O. R. H. Dose; Wing Cdr. L. S. Ford, D.F.C.; Sgt. J. D. Halvorsen; Sgt. L. B. Hewer; F/O. A. Kingsley; Sgt. R. H. McLean; Sgt. E. W. O'Connell; P/O. B. B. Reid; Sgt. J. G. F. Sansoucy; Act. Sqn. Ldr. J. G. Stronach; Sgt. J. G. Sweeney; Sgt. E. R. Swindells; F/O. J. A. Thain; W/O. W. A. Trask.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. J. C. Greenwood.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. H. Weir.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. A. MacPherson; F/O. R. P. Round.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. F. W. Letchford.

MISSING.—P/O. A. G. Cleary; Sgt. A. C. A. MacPhail; Sgt. A. McWilliam; F/O. R. J. Sim; Flt. Sgt. S. R. Thornley.

South African Air Force

KILLED ON ACTIVE SERVICE.—Lt. E. A. Baxter; 2/Lt. S. S. Beattie; Flt. Sgt. R. Murray.

DIED ON ACTIVE SERVICE.—Cpl. H. J. Adams.

Casualty Communiqué No. 270

Of the names in this list 108 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. D. McN. Hall; Sgt. R. F. Haynes; Flt. Sg. F. P. O'Brien; Sgt. I. A. Roy; Sgt. S. Underwood.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. A. G. G. Machin; P/O. C. B. A. Nichols; Sgt. J. Ramsey.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. G. R. Bennett; Sgt. A. G. Boughtwood; Sgt. G. D. M. Cliff; P/O. K. W. Clugston; Flt. Sgt. G. Cobden; Sgt. J. Coy; Sgt. A. W. Cushway; Sgt. H. R. Davies; Sgt. N. E. Dowden; Sgt. A. F. Ellis; Sgt. E. G. Follett; Sgt. R. Gibson; Flt. Sgt. L. W. Goalen; F/O. P. A. L. Gompertz; Sgt. R. F. G. Grant; Flt. Sgt. A. E. Harrison; P/O. L. Harvey; Flt. Sgt. P. Hereford; Sgt. C. C. Hockley; Sgt. E. M. Innes; Sgt. J. H. Kaufman; Sgt. R. B. Kendall; P/O. F. A. J. Laidlaw; Sgt. J. G. Leech; Sgt. W. R. Leitch; P/O. G. F. Love; Sgt. B. P. Lunn; P/O. G. McAuley; Sgt. J. McL. McIntosh; Sgt. P. McIntyre; Sgt. A. Marshall; Sgt. C. W. Miles; Sgt. G. L. A. Neale; Sgt. E. Nettleton; Sgt. P. F. O'Shea; Act. Flt. Lt. D. A. Perkins, D.F.C.; Flt. Sgt. D. B. Paton; Flt. Lt. P. D. Pool; Sgt. G. D. Rawbone; Flt. Sgt. H. R. Rowe; Sgt. J. V. Redshaw; Sgt. P. C. Robson; Sgt. A. Rooney; F/O. P. C. Sayce; Sgt. W. C. Scarlett; P/O. E. R. Senior; Sgt. D. P. Shanley; Flt. Sgt. W. Sheldon; Sgt. A. G. Silvester; Sgt. D. Smith; P/O. J. D. V. S. Stephens, D.F.M.; Flt. Sgt. S. E. Stevens; Act. F/O. J. E. Tate; P/O. E. F. Thomas; P/O. L. B. Thomas; Flt. Sgt. G. T. Thornton; P/O. E. Tonge; Sgt. J. E. Watts; Sgt. R. E. W. Williamson; Sgt. S. Wilson.

WOUNDED OR INJURED IN ACTION.—Sgt. C. Broomfield; Sgt. J. Patterson; Flt. Lt. L. S. B. Scott; Sgt. G. Wright.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. F. Malan.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. C. W. Leister; Sgt. T. Carter; Sgt. R. Fletcher; Sgt. R. Fulthorpe; F/O. F. M. Richards; Sgt. J. J. Simpson; Sgt. G. C. A. Zedy.

MISSING.—P/O. R. E. Allen; Sgt. R. J. Bailes; Sgt. N. L. Ballamy; Sgt. W. F. Barker; Sgt. C. A. S. Barnett; Sgt. L. T. Beard; Sgt. H. Biggin; Sgt. W. R. Black; Sgt. E. A. Bogle; Sgt. R. Bromley; Sgt. B. W. Card; Sgt. A. Carmichael; Sgt. W. S. Champ; Sgt. C. J. Church; Sgt. R. G. Clydon; Sgt. G. S. Cole; Flt. Sgt. F. Cuffey; Sgt. E. Dangerfield; Sgt. B. O. Davies; Sgt. D. M. Davies; Sgt. J. W. Deacon; Sgt. P. D. Deck; Sgt. W. E. Doyle; Sgt. D. A. H. Ferguson; Sgt. R. V. Fielding; Sgt. F. R. Fowler; Sgt. T. K. Fowler; Sgt. J. W. Fraser; P/O. R. H. Fry; Sgt. N. W. Fyfe; Sgt. J. R. Glendinning; P/O. D. C. Goodwin; Sgt. J. P. Harper; F/O. D. F. Hill; P/O. H. E. Howsam; Sgt. F. N. Jay; Sgt. J. J. Kerevan; Sgt. A. C. Lake; Sgt. A. McI. Law; Act. Flt. Lt. L. H. Lee; P/O. C. Lough; Sgt. W. Mitchell; P/O. R. E. Moore, D.F.M.; Sgt. R. T. Moore; Sgt. R. K. B. Muir; Sgt. J. F. Mustchin; Act. W/O. N. Nixon; Sgt. W. Oak; Sgt. N. W. Procter; Sgt. E. L. Pugh; Sgt. J. Ralph; Sgt. R. C. Relph; Sgt. J. Renwick; Sgt. H. R. Rhodes; Sgt. A. A. Rush; Flt. Sgt. E. Shaw; Sgt. P. J. Shearman; P/O. A. B. Smart, D.F.M.; Sgt. R. E. J. Smith; P/O. C. F. J. Sprack, D.F.M.; F/O. G. R. Sugar; F/O. E. A. Tilbury; P/O. K. Truelove; Sgt. R. E. Watson; Sgt. G. Whitehead; Sgt. C. Wilde; Sgt. S. Wright; P/O. S. H. Yates.

KILLED ON ACTIVE SERVICE.—Sqn. Ldr. P. E. Bennett, A.F.C.; Sgt. D. E. G. Bown; Flt. Lt. W. J. Calver; A/C.2 P. Clark; Sgt. B. J. Cox; Flt. Sgt. J. Creighton; Sgt. A. G. Debenham; Act. Sgt. H. H. Dunwell; Sgt. G. Fall; Sgt. A. Faulkner; F/O. L. W. A. Frewin; Sgt. T. Green; W/O. G. E. Harris, D.F.M.; Sgt. J. S. Harris; Sgt. M. K. Holliday; Act. Flt. Lt. C. D. Lawson; Sgt. J. Lissett; Sgt. D. McLachlan; Sgt. W. P. Morrison; Sgt. G. W. Mullis; Sgt. H. Parker; Flt. Sgt. A. Partington; Sqn. Ldr. G. M. Roddy; Sgt. L. A. Southam; Sgt. R. W. Smith; L.A/C. P. J. Stuart; A/C.2 E. E. Suckling; Sgt. K. E. Troake; Sgt. F. J. Welsby; Sgt. L. G. Williams; Sgt. G. B. T. Wymer; L.A/C. D. B. Young.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. P. R. Dean; Sgt. S. D. Curnock.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. F. F. Ross; Sgt. R. W. Sherwin.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. C. V. Fox; L.A/C. A. G. Tustain; Act. Sgt. R. J. Webb.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. P. W. Dennis; Flt. Sgt. W. M. Donaldson; Sgt. D. E. Eldred; Sgt. P. Turnbull.

DIED ON ACTIVE SERVICE.—L.A/C. R. Archibald; A/C.2 D. A. Barrett; Cpl. N. R. Collins; F/O. R. J. Dunford; Sgt. D. M. Fear; A/C.2 J. A. Goodchild; A/C.1 J. W. Lee; L.A/C. R. Lewis; A/C.2 J. Lockwood; Flt. Sgt. J. F. Nicholson; Cpl. A. L. Stather; W/O. G. H. Taylor; P/O. J. Tarbuck; A/C.1 J. Wood.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. K. Browne.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. P. F. Cartwright; Sgt. F. P. Darda; Sgt. M. J. Hudson; Sgt. L. H. Shackleton; Sgt. B. G. Shearing; Sgt. D. Wainwright; Sgt. E. E. Vine; Sgt. D. C. Young.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. L. P. Hancock; Flt. Sgt. K. McK. Leslie; A/C.1 G. W. White.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. W. J. Tucker.

MISSING.—Flt. Sgt. D. P. Birk; F/O. W. J. Dennett; F/O. W. E. Emery; F/O. A. C. R. Flashman; Sgt. T. Wilhams.

KILLED ON ACTIVE SERVICE.—Sgt. J. F. Calvesbert; Flt. Sgt. N. F. Gray; Sgt. H. P. Griffith; Flt. Sgt. C. M. Raven; Sgt. A. R. Spencer; Sgt. J. T. Sutherland.

DIED ON ACTIVE SERVICE.—Flt. Sgt. V. J. Morris.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. N. Kennedy.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. B. Cameron; Flt. Sgt. R. B. Clements; P/O. E. E. Gervais; Flt. Sgt. H. H. Harrison; Flt. Sgt. J. Jemmett; Sgt. G. W. Jewell; Sgt. H. R. Kedwell; Sgt. V. J. L. Lebano; Sgt. J. R. Metivier; Sgt. T. H. Miller; Sgt. C. G. Nugent; Flt. Sgt. J. Ott; P/O. C. W. Pafford; Sgt. J. M. Rankin; F/O. C. S. Ratcliffe; Sgt. S. Ross; P/O. P. J. C. Savage; Act. W/O. S. A. Turner; P/O. W. M. Webb; Sgt. D. Wolstenholme.

MISSING, BELIEVED KILLED IN ACTION.—F/O. L. A. Doherty.

MISSING.—F/O. R. J. Agur; Sgt. T. N. Bain; Sgt. S. D. Bird; Sgt. L. W. J. Dawson; P/O. A. G. Fletcher; Sgt. V. M. Goldstone; F/O. A. K. MacDougall; Sgt. W. D. McMurachy; F/O. G. B. Milner; P/O. P. Opurk; P/O. R. W. Potts; Sgt. R. Shaw; Sgt. E. J. St. Germain; F/O. D. R. L. Wilson.

KILLED ON ACTIVE SERVICE.—P/O. T. W. Adam; F/O. R. E. G. Agassis; P/O. G. Booth; Sgt. M. H. Cornell; F/O. W. C. Davies; P/O. R. J. C. Dupraz; Sgt. J. C. Kent; P/O. A. L. Macrae; Sgt. E. H. Palava; Sgt. C. L. Pudney; F/O. D. Williams.

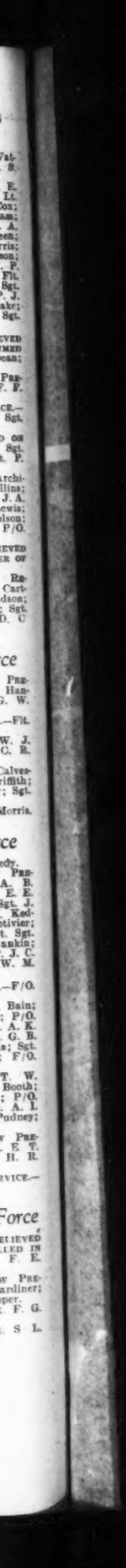
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. T. O'Neil; P/O. G. R. Stratford; Sgt. F. H. H. Wright.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. R. J. Pilon.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. D. Follett; Sgt. F. E. Kearns; Sgt. M. Swann.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. K. F. Gardiner; P/O. J. D. McGregor; Flt. Sgt. T. B. Pepper.

MISSING.—W/O. N. H. Lafiy; Flt. Sgt. F. G. McKay; Flt. Sgt. I. R. V. Ruff.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. S. L. Pointon.